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OF
CHICAGO

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SURGICAL CLINICS OF CHICAGO

Volume 3 Number 4

CLINIC OF LIEUT.-COL. DEAN LEWIS

U. S. A. General Hospital No. 28, Fort Sheridan, Illinois

PERIPHERAL NERVE SURGERY

Summary: A series of cases illustrating the common results of injury to peripheral nerves and the method of choice for the correction of each condition.

Numerous problems are presented in peripheral nerve lesions. Cases of compression by scar tissue and bony callus; partial and complete anatomic interruptions in which suture can be easily performed; and cases of complete division with loss of substance, in which many different methods of repair have been attempted without any great degree of success, are encountered.

Case I.—The first patient upon whom I shall operate was wounded on October 1, 1918, in the Argonne. He sustained a gunshot wound of the left arm and another of the right side of the jaw. These wounds were caused by fragments of high explosive. The wound of the jaw was followed by hemorrhage into the neck causing compression, for the relief of which tracheotomy was performed. The wound of the left arm, the scar of which you see, was not a perforating wound, and the fragment of high explosive was so superficial that it could be picked out of the wound with tissue forceps. This fragment fractured the humerus, although it did not reach the bone.

Immediately after the patient was struck he noticed that he was unable to extend the wrist. Inability to extend the wrist has persisted up to this time. There is no marked atrophy of the extensor muscles on the back of the forearm, but the patient is unable to extend the wrist or fingers, and when such an attempt is made the fingers assume the step-ladder position so often seen in this type of paralysis. Upon examination there is found a dissociated sensory syndrome, and the sensory changes are localized to the small area in the web between the thumb and index-finger on the dorsal side.

Palpation of the musculospiral nerve fails to reveal a neuroma, although the musculospiral nerve can be palpated in the groove for a considerable distance. The absence of the neuroma and the presence of a compression syndrome would warrant one in making a diagnosis of physiologic rather than anatomic interruption. The physiologic interruption has lasted so long that one is justified in exposing the nerve, for the chances of spontaneous recovery of function are practically nil.

I will expose the nerve by an oblique incision over the course of the musculospiral nerve, extending from above and backward, downward, and forward on the posterior and outer side of the arm.

The scar of the previous wound is avoided, as the scars resulting from gunshot wounds are apt to slough if an incision is made which separates them from the underlying tissues.

As the dissection is made down to the musculospiral groove, little or no scar tissue is encountered. This case differs in this very markedly from a number of cases in which the scar tissue was very dense.

As the musculospiral nerve is exposed at the lower end of the musculospiral groove it is found to be compressed by a very delicate piece of connective tissue (Fig. 257). The constricting band is circular, and the diameter of the nerve is reduced almost one-half by this delicate constricting band. It seems almost as if a fine suture had been tied about the nerve at this point. As I divide the constricting band and lift the nerve out of its bed I am struck by the fact that there is no anatomic change in the nerve except the reduction in diameter by about one-half. The constricted area is, however, soft, and on the proximal side of the constriction no neuroma is found. There is no cicatricial change in the nerve at any point. It is quite evident from these findings that we are dealing with a case of simple compression. The diagnosis of nerve compression which was made clinically corresponds to the changes found at operation.

The only thing required in an operative way is division of the constricting band. In order, however, to avoid the recurrence of a constricting band I shall perform neurolysis, an operation of very distinct value in cases of this kind.

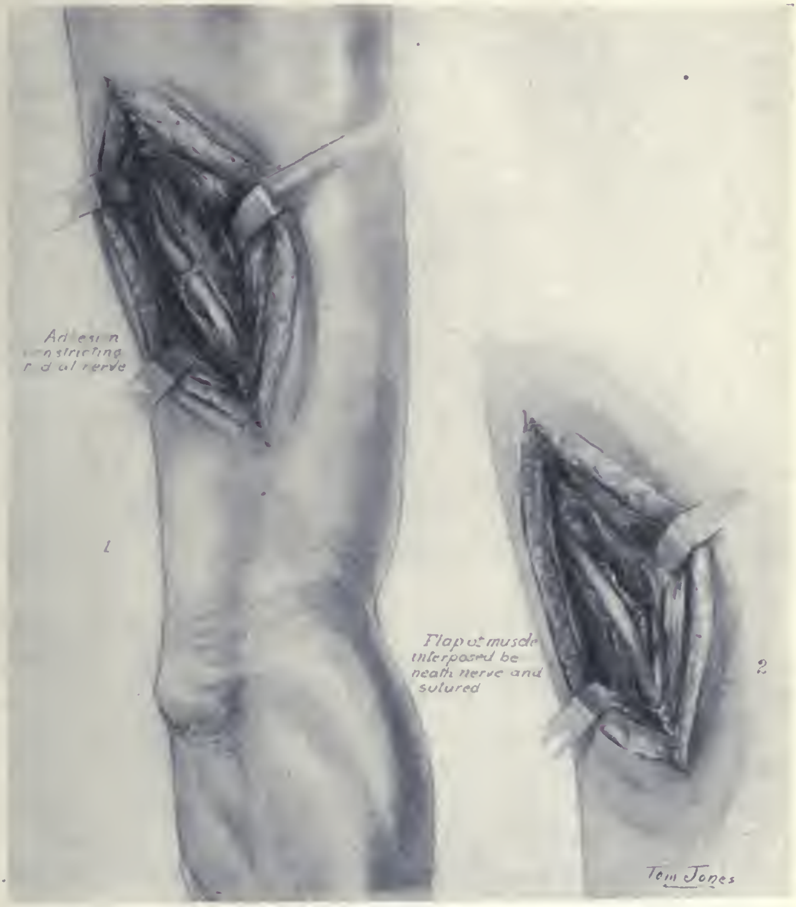

Adhesion constricting radial nerve
1
Flap of muscle interposed beneath nerve and sutured
2
Tom Jones

Fig. 257.—Complete physiologic interruption of left musculospiral nerve due to a delicate constricting band, following a penetrating wound by a piece of an explosive shell. In this case there was also a fracture of the humerus. Excision of the scar, followed by muscle neurolysis, was performed. First evidence of return of motor power noted in ten days.

The nerve is lifted out of its bed, for the constricting band which held it has been cut away. In order to avoid the possibility of recurrence of compression the nerve will be placed in a new bed.

Numerous methods of performing neurolysis have been proposed, such as surrounding the nerve with Cargile membrane, free or pedunculated fat transplants, or formalinized calves' arteries, etc. In this case the dissection has been made as nearly as possible along the intermuscular septum, and an attempt will be made to perform what may be called a muscle neurolysis. In any operation upon injured nerves the dissection should be made, when possible, along intermuscular septa, because hemorrhage is thus avoided, and when the operation is completed the freed nerve, or the suture line, providing suture has been performed, can be placed in a bed between muscle-fibers which have not been injured. The recurrence of adhesions is thus avoided. In this instance the triceps muscle can easily be sutured under the nerve and the outer border of the biceps can be sutured over it. When this operation is completed the nerve lies comfortably in a new bed. Little hemorrhage has occurred. What has occurred has been easily controlled, and I do not believe that we need fear the formation of new adhesions about the nerve.

Neurolysis has a distinct place in nerve suture. Hashimoto, operating upon the wounded in the Russo-Japanese War, had considerable experience with Foramitti's method, which consisted of surrounding the freed nerve or the suture line with calf's artery hardened in 10 per cent. formalin. Such an artery causes little or no reaction in the surrounding tissues. I prefer, however, to use neighboring muscles for this purpose, and in the majority of cases muscles adjacent to the injured nerve can be used. When muscle cannot be used for this purpose, a free fat transplant may be employed.

The pathology in this case is exceedingly interesting. The physiologic interruption of the nerve has been caused by a very delicate circular band of scar tissue. In spite of the constriction which has lasted for some months there has occurred no gross anatomic change in either the compressed segment or in the nerve proximal to it. The circumference of the nerve must have been reduced one-half at the point of constriction. This patient should make a complete recovery.

Note.—Ten days after this operation was performed there was noted a decided return of motor power in the muscles supplied by the injured nerve. Voluntary movements were noted in some of the muscles supplied by it. Four weeks after operation the patient had good control of the extensor scarpi radialis longior and brevior. The action of the extensor communis digitorum returned much more slowly.

Case II.—This patient was wounded August 8, 1918, at Fismes. He received a perforating gunshot wound of the lower part of the left thigh at that time. The wound of exit is found directly to the outer side of the external popliteal nerve at a point just below the middle of the popliteal fossa. Immediately after this wound was received the patient noted that he was unable to raise the foot. This foot-drop has persisted ever since the injury was received. There is some atrophy of the anterior tibial group of muscles; and the reaction of degeneration and anesthesia such as occurs normally with divisions of the external popliteal nerve.

When the external popliteal nerve is palpated a nodule is found just above the scar caused by the foreign body. When pressure is made upon this nodule the patient complains of a tingling sensation which radiates into the foot. This radiation corresponds to the distribution of the filaments of the external popliteal nerve in the foot.

With these clinical findings there can be no doubt but that we are dealing with an anatomic division of the external popliteal nerve.

In making the incision to expose this nerve which passes along the inner border of the biceps tendon it will be prolonged downward in a curve on to the anterior surface of the leg, so that the distal segment of the nerve may be mobilized if there is any difficulty in making an end-to-end suture.

When the nerve is exposed a bulbous end—a distinct neuroma —is found on the distal end of the proximal segment. This

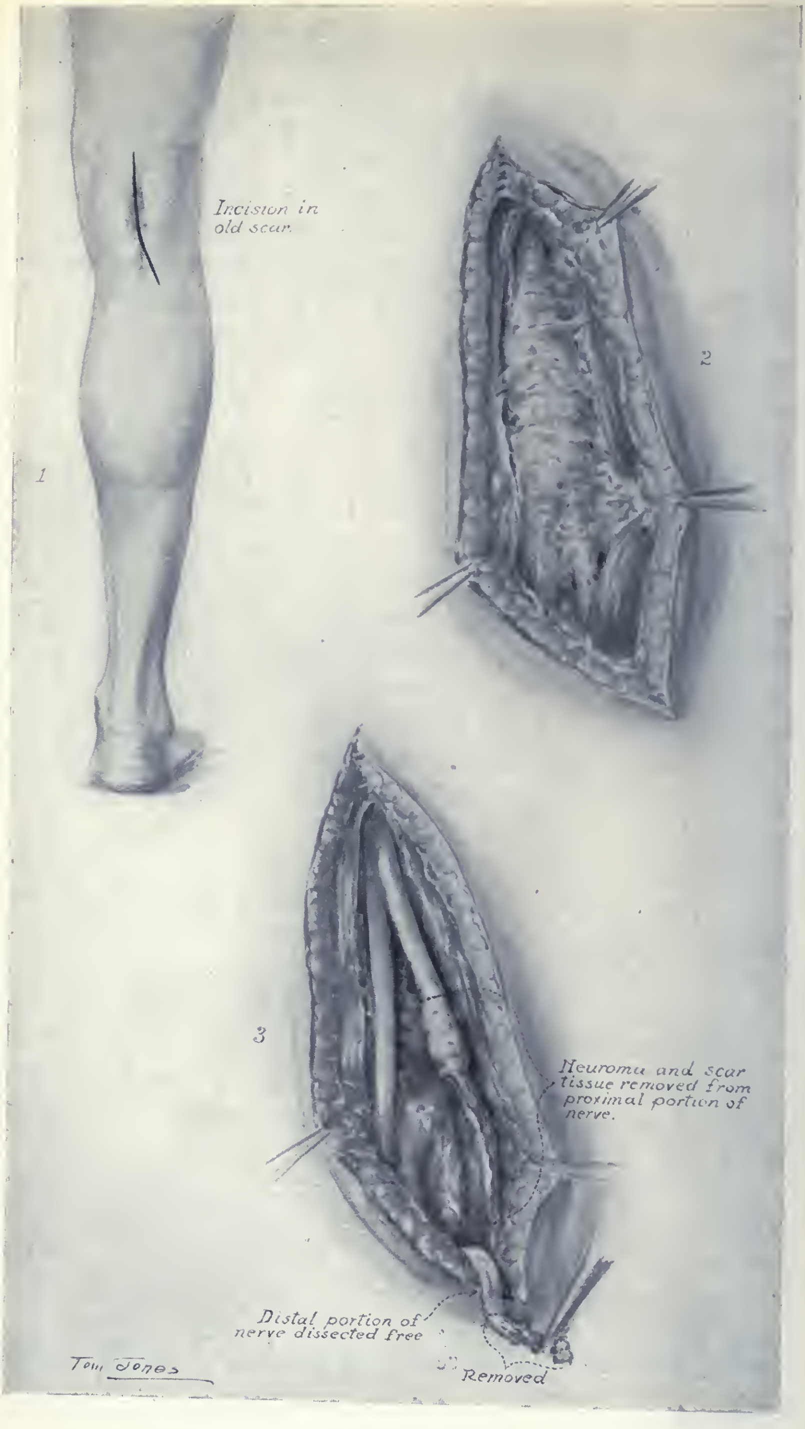
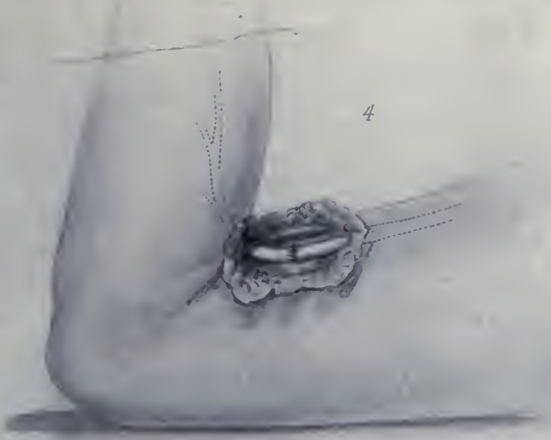

Incision in old scar.
1
2
3
Neuroma and scar tissue removed from proximal portion of nerve.
Distal portion of nerve dissected free
Removed
Tom Jones

Fig. 258



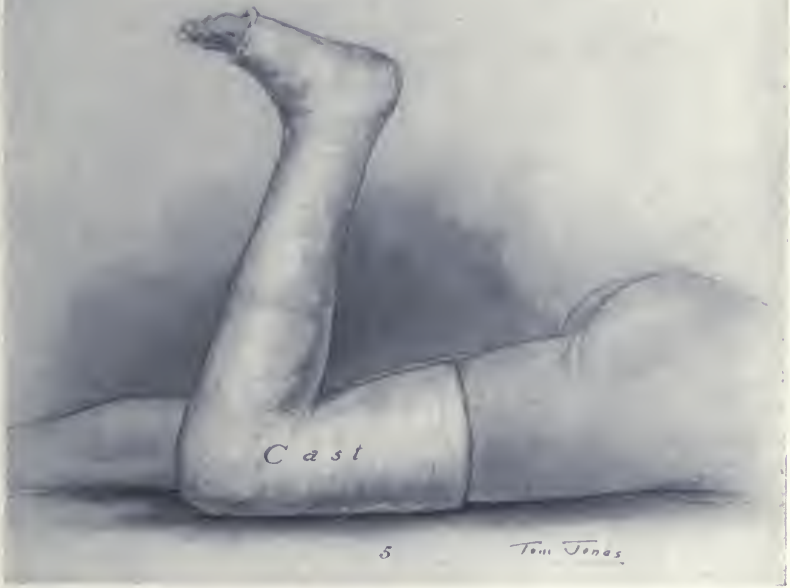


Fig. 259.

Figs. 258, 259.—Complete anatomic division of external popliteal nerve. Resection of scar tissue from both ends of nerve until healthy neurofibrillæ were exposed. End-to-end suture of nerve after knee is flexed to a right angle. Fixation in a plaster-of-Paris cast is maintained for four weeks. At the end of this time gradual extension of the knee is begun.

bulbous end is connected with the proximal end of the distal segment, from which it is separated for some distance by a band of cicatricial tissue.

The ends of the nerve with the intervening scar tissue are dissected free; apparently the two ends can be easily brought together when the scar tissue is resected. The ends are cut away with a small sharp knife—a safety razor blade may be used for this purpose—in order to avoid trauma. The nerve ends are resected until healthy neurofibrillæ herniate from the ends of the nerve. Scar tissue interferes with nerve regeneration, and one of the commonest causes of failure of regeneration is insufficient resection of nerve ends. It is difficult in some instances to determine how much of the nerve ends should be resected. In many cases neurofibrillæ are seen after the ends are resected, but these are matted together and appear edematous. In some instances this condition of the neurofibrillæ is associated with thickening of the epineurium. When such is the case three or four longitudinal incisions should be made in the epineurium, for I believe that this edema and matting of the neurofibrillæ is the result of a circulatory change due to constriction by thickened epineurium.

When the knee is flexed the ends of this nerve can easily be brought together without tension. Flexion to an angle of 70 degrees suffices. I prefer fine black silk sutures prepared with carbolized beeswax for uniting the ends of the nerve. Five or six sutures will suffice to approximate the ends. These are passed through the epineurium after hemorrhage from the ends of the nerves has been controlled. These sutures are not tied tightly. The ends of the nerves are merely approximated, no attempt being made to force them together. When these sutures are carefully and accurately applied the cut edges of the epineurium of both nerve ends will be coapted and there will be no bulging of neurofibrillæ outside the line of suture. A circular suture of the epineurium has been recommended. I believe that it is not necessary. The fewer sutures, the better, and with the number which I have inserted the nerve ends can be accurately approximated (Figs. 258, 259).

A plaster-of-Paris cast will be applied to the leg, with the leg in flexion. This position will be maintained for four weeks, after which the cast will be removed and the leg gradually extended. In some cases in which a greater space exists between the ends and suture is made with greater difficulty, fixation must be maintained for a longer time.

Case III.—This patient presents a painful lesion of the hand. This painful type of lesion was described by Weir Mitchell in the Civil War and was called "causalgia" by him. The term is derived from the Greek word *καιω*, meaning I burn. "Caustic" has the same derivation. A burning pain is the symptom of which these patients complain most bitterly.

This patient was wounded July 17, 1918, at Chateau Thierry. A machine-gun bullet passed through the left arm midway between the shoulder and elbow, fracturing the left humerus. The wound was debrided and healing occurred. For a short time there existed a musculospiral paralysis, but this has gradually disappeared.

This patient now complains bitterly of a burning sensation in the hand. The burning is so intense that the patient goes frequently to the cold water tap and holds his hand under it. At times he will wrap the hand in a towel soaked with cold water or wear a glove which has been soaked. The condition of these patients is well described in Benisty's book as follows:

"The incessant pain which dates from the early months of the injury and which never ceases, even at night, suddenly increases owing to causes, which the unfortunate patient delights in describing in the minutest detail.

"An attack is usually brought on or prolonged by bending the hand down; so patients always keep it up. Exposure to air, dry heat, particularly a hot atmosphere, noise, sudden and bright light, deep breathing, coughing, sneezing, and laughing have the same effect. Emotional causes soon come into play, such as the sight of a wide open expanse, an empty space, looking out of a window or descending a staircase, meeting a relative, the doctor's visit—in fact, any emotion is said to increase the pain. Then the condition becomes aggravated; the patients can no longer bear to see their fellow patients play or to hear them laugh because they are afraid of an accident. A comrade walking across a polished floor on crutches, the sight of anyone leaning out of a window, a workman on a roof, the flight of an aëroplane, or anything that suggests the possibility of a fall or giddiness intensifies the pain."

This patient has a distressed facial expression. He is melancholy and wishes to be let alone.

When the hand is examined there is no definite paralysis. The limitation of motion which is present is due to fear of increased pain if the hand is moved. The fingers are thin and tapering, the skin white, shiny, and atrophic. The skin is dry, there being no perspiration, but the dryness is not so marked that the skin chaps and scales off.

The patient holds his elbow flexed. The wrist is curved inward. The hand is raised and the fingers extend. In some cases the terminal phalanx may be hyperextended.

These symptoms are probably the result of an ascending neuritis. In causalgia of the hand the median nerve is the one usually involved; in causalgia of the foot, the internal popliteal. We have here in the hospital a causalgia of the lower extremity in which some of the pain has been relieved by alcoholic injection of the internal popliteal nerve, but a burning pain still persists over the distribution of the long saphenous.

There is another case of causalgia of the hand in which a machine-gun bullet injured both the median and musculospiral nerves. There is practically no paralysis in this case and the burning pain is not associated with any trophic changes. The pain in this case is aggravated on a hot day. The symptoms appear like those of causalgia, but I do not believe them severe enough to require injection of the nerve.

The case under consideration is so severe that relief from the pain is imperative. I will expose both the ulnar and median nerves. Both of these are bound down in scar tissue, but they are easily freed. In the case of the median the most marked pathology is found at the entrance to the antecubital fossa. The median nerve is usually the seat of an ascending neuritis in these cases, and I shall inject it with 60 per cent. alcohol, which at most will cause but temporary paralysis (Fig. 260). The patient will recover the use of the muscles supplied by the nerve injected as soon as he would without, for the pain following movement would inhibit use of the muscles for that length of time anyway.

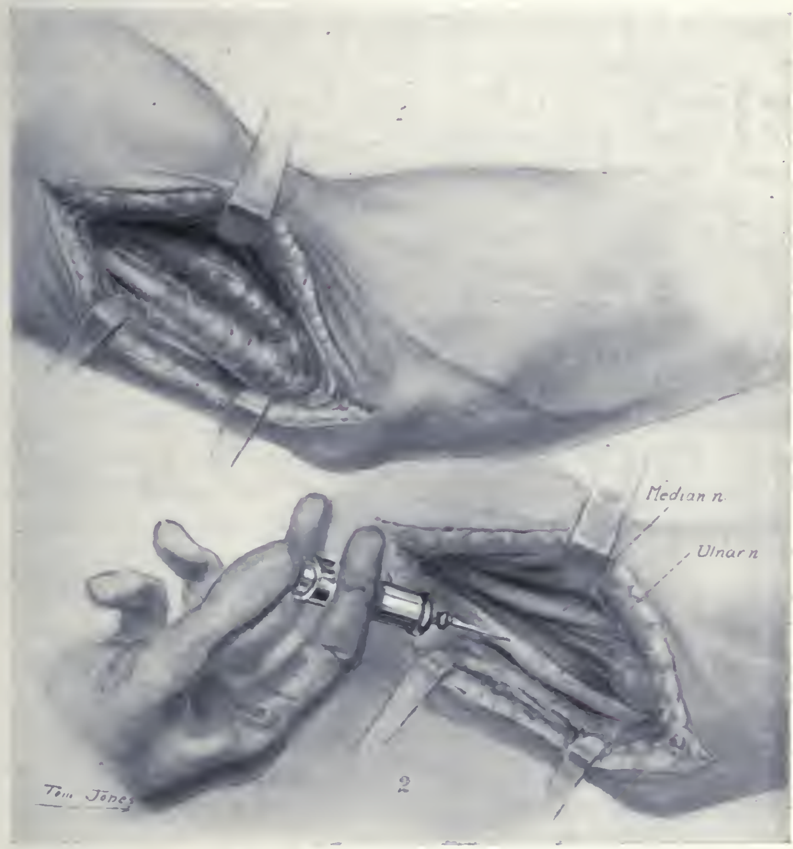


Fig. 260.—Injection of 60 per cent. alcohol into the median nerve to cure causalgia following injury and cicatricial compression of the median nerve.

x-Ray treatment of these lesions has been advocated. Leriche removed the periarterial sheath of the sympathetic in a case of lesion of the brachial plexus and the pain was greatly relieved.

These patients are greatly relieved by alcoholic injection, and this is such a simple procedure that it should be attempted. These cases tend to recover spontaneously. In six months the worst period has usually been reached, and from then on there is gradual improvement. During this period care should be exercised that contractures do not develop.

Case IV.—This patient was wounded August 31, 1918, while standing in a trench shooting over a parapet. The machine-gun bullet entered below the coracoid process on the right side and, ranging downward and outward, made its exit at the middle of the axillary border of the scapula. Immediately after the bullet struck there was complete paralysis of the hand and forearm on the right side. A history of suture of the ulnar nerve five days after the injury is given. There has been gradual return of musculospiral nerve function on this side. The patient has no record with him of what operative procedure has been employed, but there has been no improvement in sensory or motor function for so many months that an exploration of the nerve is justified. There are distinct evidences in this case that the principal vessels of this extremity have been severed. These evidences are decided vasomotor changes. The hands are blue or, rather, bluish red. In most of the cases that we have observed in which there have been vasomotor disturbances there have been injuries of the vessels. The location of the wound would indicate that an injury to the principal vessels might easily have occurred.

I will expose the plexus in this instance by a long incision which parallels the groove between the deltoid and pectoralis major muscle. These muscles are separated, but to better expose the lower part of the cords of the brachial plexus the tendon of the pectoralis major will be divided at its point of insertion. When this is divided the seat of the lesion comes into view, for there is a large amount of rather dense scar tissue in which the nerves are undoubtedly embedded.

In order to avoid traumatism of the nerves and to facilitate the dissection the nerves will first be exposed in the arm and traced upward. These nerves are easily found below in their normal relations. It is a general principle of surgery of this type that all dissections should be made over healthy portions of the nerves first, where the nerves are found in their normal relations. In this way undue injury to the nerve from extensive manipulation and dissection is avoided.

As these nerves are traced backward toward the axilla rather dense scar tissue is encountered. This should be divided by sharp dissection, for traumatism to the nerve is thus avoided.

When these nerves have been freed there is found no interruption in continuity. It cannot be stated from the findings whether or not there has been a division of the ulnar nerve. In the history elicited from the patient there is an indication that the ulnar nerve had been sutured. If it has, continuity of the nerve has been established and maintained.

The next thing to be determined is whether or not the median and ulnar nerves should be resected. The nodules or, rather, somewhat spindle-like enlargements on both nerves are soft. They have a slightly yellowish appearance. They neither look nor feel like the hard cicatricial tissue which forms a block to regenerating neurofibrillæ. When there is a possibility that neurofibrillæ will pass through a nerve at the point of injury and neurotize the distal segment resection should never be thought of. If a resection and end-to-end suture should be attempted, any regeneration which has occurred would be lost, and, besides, the results of such an operation may be doubtful. Removal of the scar tissue about these nerves at the site of the injury, followed by some procedure designed to prevent the redevelopment of this scar tissue, is all that is indicated (Figs. 261, 262).

Some of the pectoralis major will be used to place over the rather dense cicatricial bed, which has been partially removed in this case. This muscle will undoubtedly undergo atrophy and partial absorption, but I do not believe that it will form a heavy scar. The remainder of the pectoralis major is sutured over these nerves after hemorrhage has been controlled.

I do not believe that there is at the site of the lesion in these nerves any block to regenerating neurofibrillæ. Recovery should

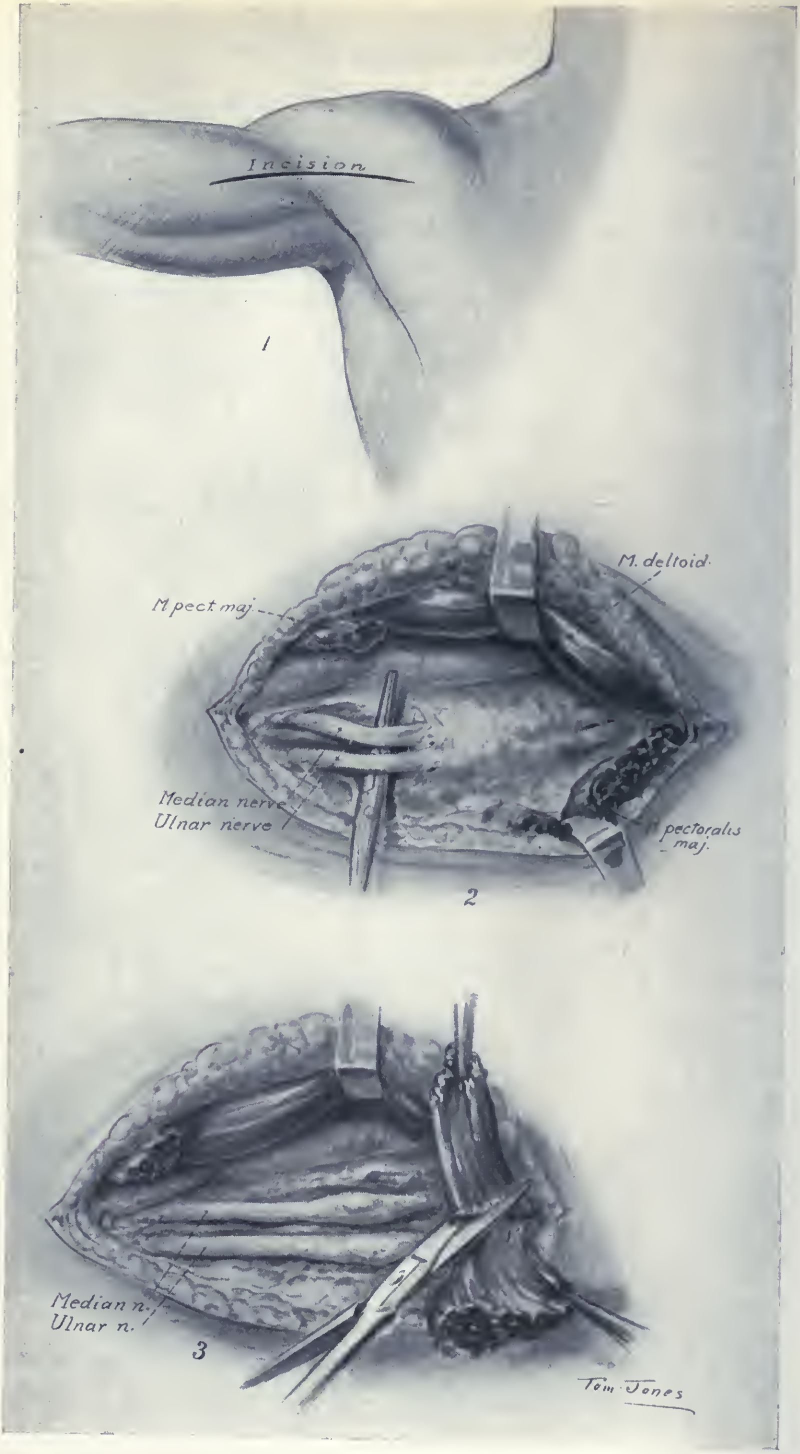

Incision
1
M. deltoid
M pect. maj.
Median nerve
Ulnar nerve
pectoralis maj.
2
Median n.
Ulnar n.
3
Tom Jones

Fig. 261.

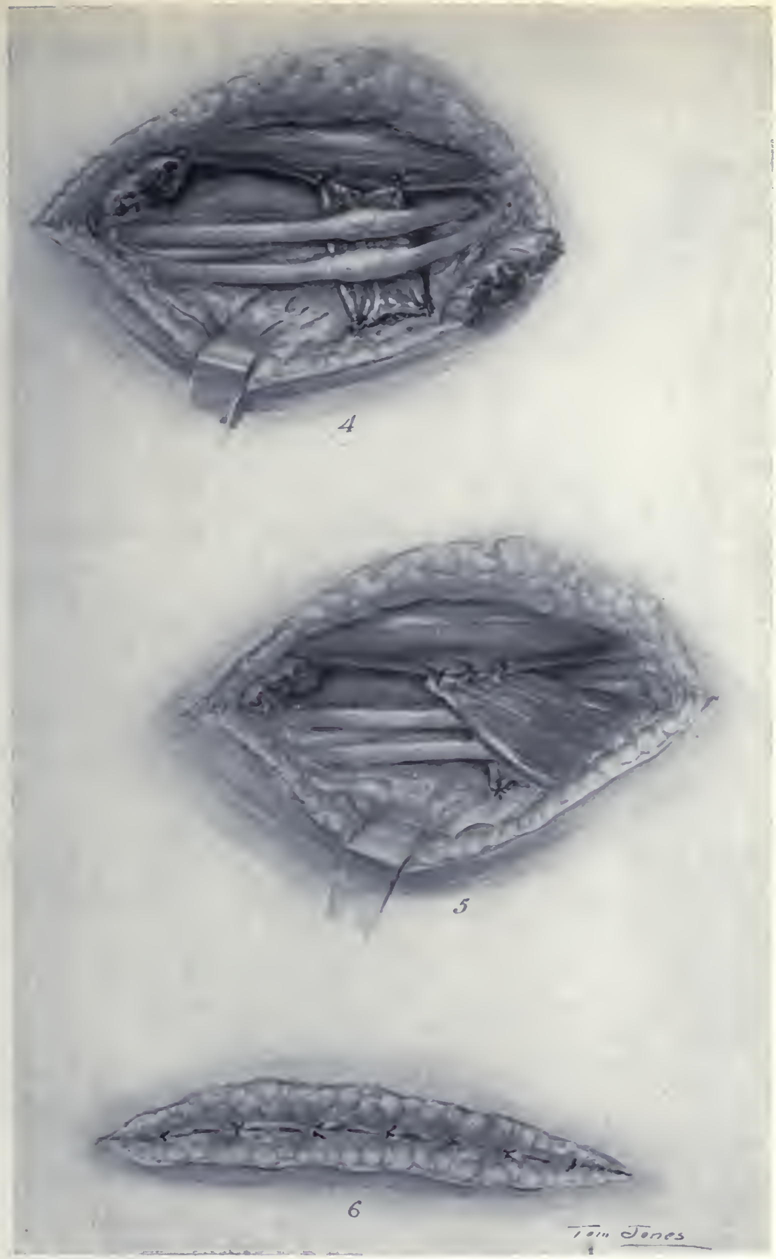


Fig. 262.

Figs. 261, 262.—Illustrating steps of freeing median and ulnar nerves in the axilla. Note enlargements of both nerves. These are soft and not due to scar tissue. Resection is not indicated. Whenever there is a possibility that neurofibrillæ will pass through an enlargement of this type resection followed by suture should never be attempted.

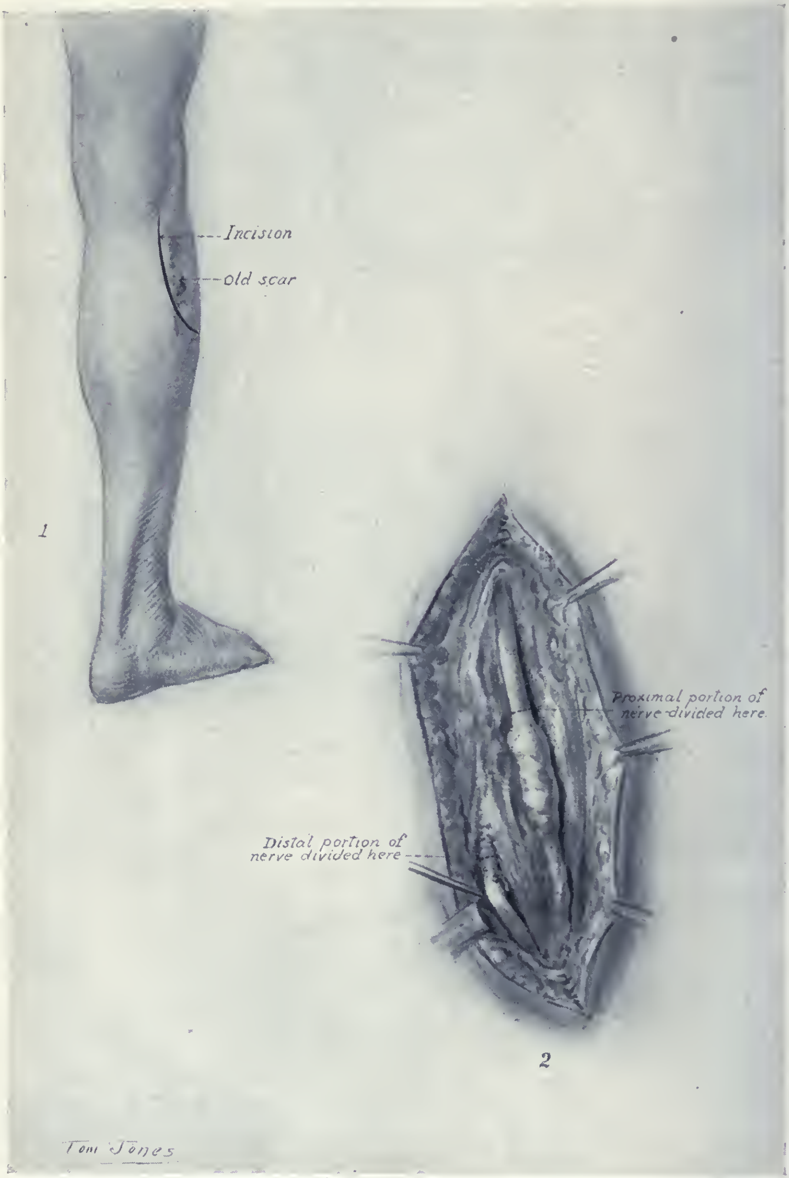

Incision
old scar
1
Proximal portion of nerve divided here
Distal portion of nerve divided here
2
Tom Jones

Fig. 263.

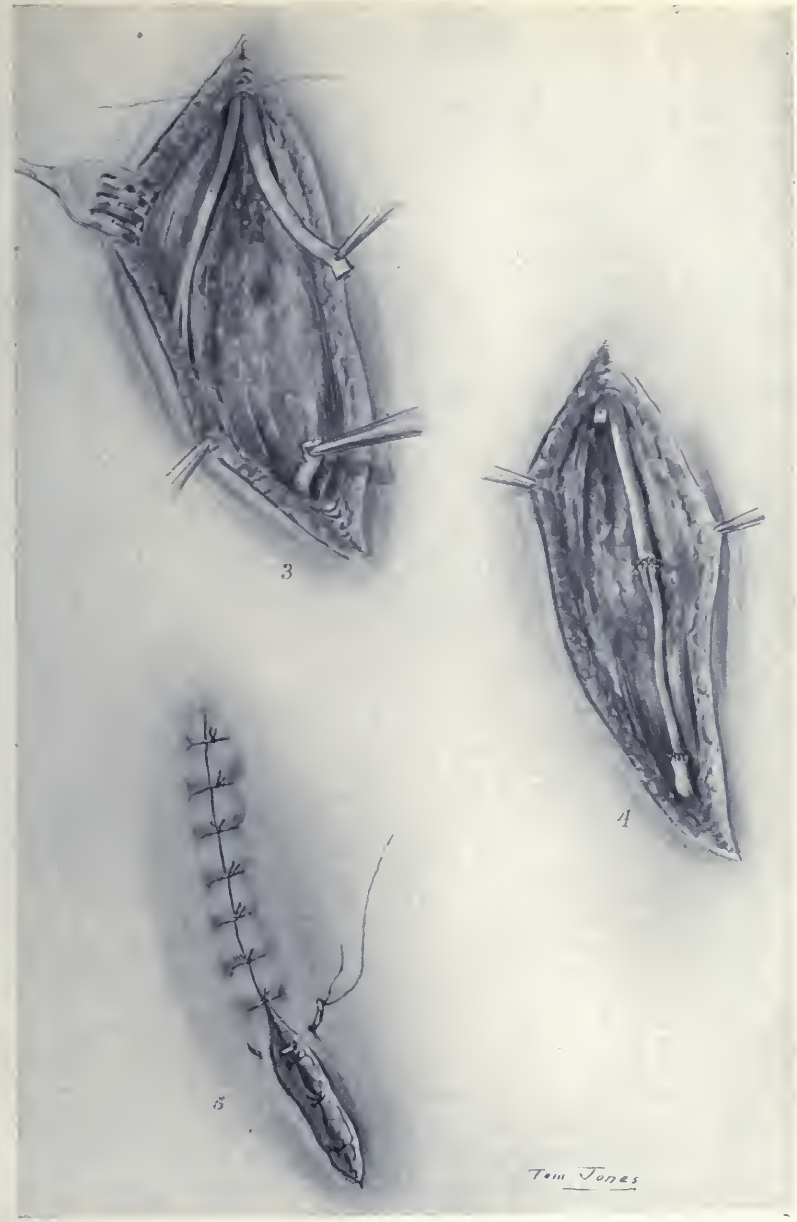


Fig. 264.

Figs. 263, 264.—Use of the autograft. A long defect remained after resection of scar tissue. End-to-end suture was not possible even after flexion of the knee. The autograft in this case was taken from the short saphenous nerve and its communicating branch from the external popliteal nerve.

eventually occur, although it may require some time. During the time in which recovery is occurring every effort should be made to prevent the development of deformities and contractures. Physiotherapy should be employed and dressings applied so that the muscles affected should be in the state of relaxation.

Case V.—This patient was wounded October 19, 1918, in the Verdun sector. He sustained a high explosive wound of the right leg just below the knee on the outer and posterior aspect. The scar which remains after wound healing is found over the outer side of the head of the fibula.

The incision which is employed in lesions of this type is seen in the accompanying figures. The lower part of the incision is curved forward on to the anterior surface of the leg, so that when it becomes necessary to locate the superficial and deep branches of the external popliteal nerve they may be found in their normal anatomic relations.

There has undoubtedly occurred in this case a complete interruption of the nerve. No return of motor function has occurred. There has been no contraction of anesthetic fields. At least no contraction which is at all significant. When the course of the external popliteal nerve is palpated a distinct neuroma is found. When pressure is made upon this a tingling sensation is experienced in the leg and foot of the patient which corresponds to the terminal distribution of the nerve.

After the scar tissue is resected in this instance a long defect remains. The ends of the nerves cannot be united even after flexion of the knee to an acute angle. Nerve transplantation will be attempted.

The communicating branch to the short saphenous is exposed. As it is dissected out it is found to divide into two branches below. This segment of nerve is removed. I prefer to put in several grafts and to perform what is called an autocable transplantation. By spreading out the two branches of the extremity of the transplant I can cover in this case the greater part of the distal end of the proximal segment. The proximal end of the distal segment can also be covered by spreading out by suture the original proximal end of the transplant. I believe that enough neurofibrillæ will pass through this transplant into the distal segment to complete neurotization of the distal segment and the motor end plates. This is the result desired (Figs. 263, 264).

In performing this operation, or any nerve operation, pinching of the nerve or any undue roughness should be avoided. Mention is again made of this because in the figure too much of the nerve is grasped by forceps.

At the present time only a little over 30 per cent. of these cases are being operated upon. If a diagnosis of complete anatomic or physiologic interruption is made an operation is performed.

End-to-end suture is the only operation where anatomic interruption exists which gives any assurance of a high percentage of recoveries. An attempt should always be made to secure an end-to-end union. Even when there are long defects this can be done by posture.

The procedure which should be attempted when end-to-end suture cannot be performed is nerve grafting. An autograft should be used—an autocable transplant being inserted.

Neurolysis is an operation which must be performed often. Muscle neurolysis is much preferable to any other type.

Careful and diligent after-treatment is required in these cases. Treatment in almost all cases has just begun when the operative procedure has been completed.

CLINIC OF MAJOR C. C. NESSELRODE

General Hospital No. 28, Fort Sheridan, Illinois

CLOSURE OF CRANIAL DEFECTS BY OSTEOPERIOSTEAL GRAFTS TAKEN FROM THE TIBIA

Summary: The "trephine syndrome"; demonstration of a case; cure of syndrome by closure of cranial defect; technic of operation; choice of material for transplantation; advantages of bone over cartilage.

In connection with the cases showing cranial defects there has arisen a definite syndrome or symptom-complex, known as the "trephine syndrome." This is characterized by, first, a sensation of emptiness in the trephined area; second, unpleasant sensations, such as vertigo or nausea on stooping or other sudden changes of position. When the patient is in the upright position there appears in the site of the trephine a definite depression; when he bends over a hernia is seen to appear in the same place. These continuous movements of the brain disturb the patient. Third, these patients cannot tolerate external vibrations, such as the moving of a train, the shaking of an automobile, etc. These patients, as a rule, are unable to tolerate the movies because of the constant flicker of the film. Fourth, headache and other symptoms of meningeal irritation due to adhesions between the meninges and the cicatrix present in the trephined area.

The trephine syndrome disappears almost entirely after a properly performed plastic operation on the skull, but any concomitant organic lesion that may be present is in no way directly benefited.

A case of hemiplegia will take its usual course, the patient obtaining merely the suppression of the irritable cortical symptoms through the cranial plastic operation. This is easily understood, and if there is present any organic lesion, this fact should be explained to the patient.

Chutro gives it as his opinion that all loss of substance from the skull, both small and large, should be closed by a graft. He also gives it as his opinion that cranioplastic operations cause the disappearance of all of the principal signs of the trephine syndrome. The last to disappear is the vertigo.

Concerning the best procedure for grafting, Chutro prefers cartilaginous graft. He states that except in a few fortunate cases the plates of foreign matter, such as metal, ivory, celluloid, or dead bone, are cast out at the end of a certain time. As to the choice between dead and living grafts, there is no longer any doubt of the latter being preferable.

The advantages claimed for cartilage are the ease with which it is procured and also the ease with which it is cut and bent to fit the cranial defect. Personally we prefer the tibial transplants, feeling that thereby we are restoring the skull more nearly to normal.

In illustration of the preceding statements I present this patient: G. H. S., private, Co. C., 58th Inf. Teamster. American by birth. White.

Family History.—Father, good health, aged fifty-five. Mother, good health, aged sixty. Two brothers and two sisters living and well. One sister died at the age of thirty-two following childbirth.

Early History.—Measles at age of ten, mumps at twelve, small-pox at sixteen.

Past History.—Negative except for accidental loss of left thumb August, 1916.

Habits.—Occasional glass of beer. Uses tobacco moderately.

Present History.—On September 26th went into action with 4th Division at beginning of Argonne-Meuse offensive, and on October 4th was struck on right side of head by a piece of high explosive, size of palm of hand. Was knocked down and rendered unconscious for a very short period of time. Then assisted to his feet by a comrade and walked half a mile to edge of woods. There he sat down and, as he says, soon fell asleep, and remembers nothing more except the injection of antitetanic serum and the shaving of his head until two days after the operation, which was done on October 6th at Evacuation Hospital No. 4. The record shows that at operation there were removed several pieces of foreign bodies and numerous pieces of detached bone, leaving a large cranial defect over which the scalp was closed. The record available does not indicate an injury to the brain, and we conclude there was none, as the patient has never suffered any paralysis or convulsions. The wound was healed at the end of a month. He remained in bed until about December 10th. On December 16th was started from Base Hospital No. 52 on his journey home, which he made with many interruptions.

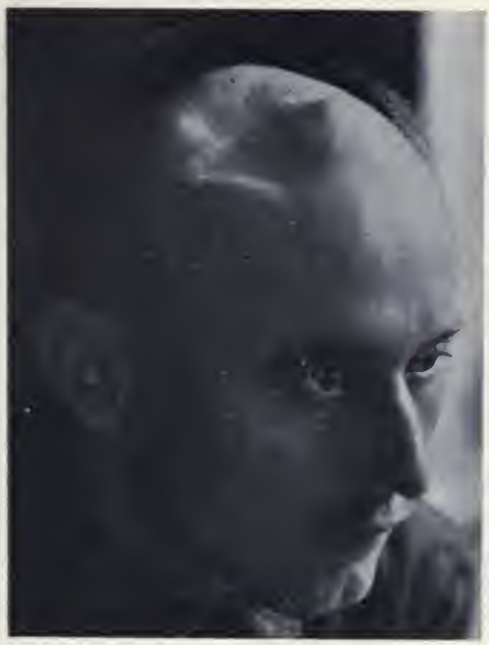


Fig. 265.—Defect in parietal region before operation.

Arrived at General Hospital No. 28 on February 28, 1919. Physical condition on arrival at hospital: Well nourished; weighed 175 pounds.

Special senses: Normal. Pupils react to light and distance.

Skin and mucous membranes: Clear.

Glandular system: No enlargement of superficial glands.

Vascular system: Pulse full, soft, regular.

Blood-pressure: Normal.

Heart: Normal, no murmurs; no arhythmia.

Lungs: Normal.

Abdomen: Normal. Soft and well formed.

Nervous system: Reflexes present and normal, no paralysis or other evidence of involvement of nervous system.

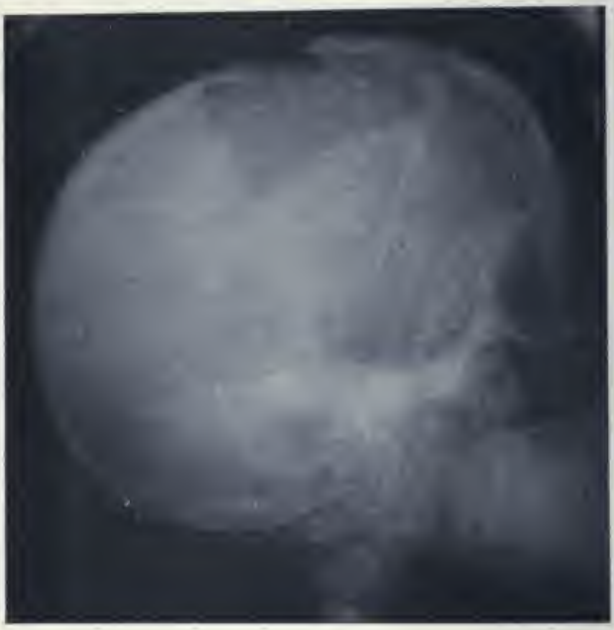


Fig. 266.—*x*-Ray of skull defect prior to operation.

Osseous system: Large defect of skull in right parietofrontal region. Defect is kite-shaped, measuring $5\frac{1}{2}$ inches in its extreme length and $3\frac{1}{2}$ inches in its extreme width. Its long axis is at right angles to the longitudinal sinus, which is crossed by the longer arm of the kite-shaped defect to the distance of 1 inch in the line of the coronal suture. At the site of the defect is a marked depression when patient is in upright position, but a hernia cerebri on stooping (Figs. 265, 266).

Muscles and joints: All normal and active.

Diagnosis on transfer card: Gunshot wound of right parieto-frontal region.

Fracture of skull with large cranial defect.

The patient complains at this time of dizziness on change of position, some headache, and blurring of vision. He is markedly depressed, refusing to take any part in ward conversations, but keeps to himself at all times. Is very sensitive and concerned about his head and wears his hat to hide the pulsating defect.

Operation.—Our incision follows the scar of the previous operation and turns the flaps back in the four directions (Fig. 267, 1, 2) from a common point in the center of the depression. Great care is taken in dissecting the scalp from the underlying dura not to open the dura. The flaps having been reflected sufficiently to expose the free bony edge of the cranial defect throughout its entire circumference, we next make an incision through the periosteum on the outer surface of the skull about $\frac{1}{4}$ inch external to the free edge (Fig. 267, 2). From this we reflect the periosteum inward and downward, leaving the free edge entirely denuded of its periosteum (Fig. 267, 3). We now free the dura-periosteal layer from the inner surface for the distance of $\frac{1}{2}$ inch. This is done with great care not to rupture the same and expose the cortex of the brain. The object in freeing the periosteum is not only to free the bone edges of fibrous tissue but also to form a pocket into which the edges of the graft may be inserted.

The bed for the graft is thus completed, and we now turn to procuring the graft. It is well to take measurements first and have in mind the exact place the graft is to be placed before it is cut. In this way one can save much material, and in a case as extensive as this one it is always a question of where to get enough grafts. Our first graft will be 4 inches in length and somewhat pointed at one end, and is to close the arm of the cavity extending down lateralward, the mesial end to be interlocked beneath the shoulder extending from the anteromesial border. The graft is outlined on the face of the tibia, then cut with a rotary saw to the depth of $\frac{1}{4}$ inch, and separated from underlying bone with a thin sharp chisel. Since it is a convex surface that is to be closed

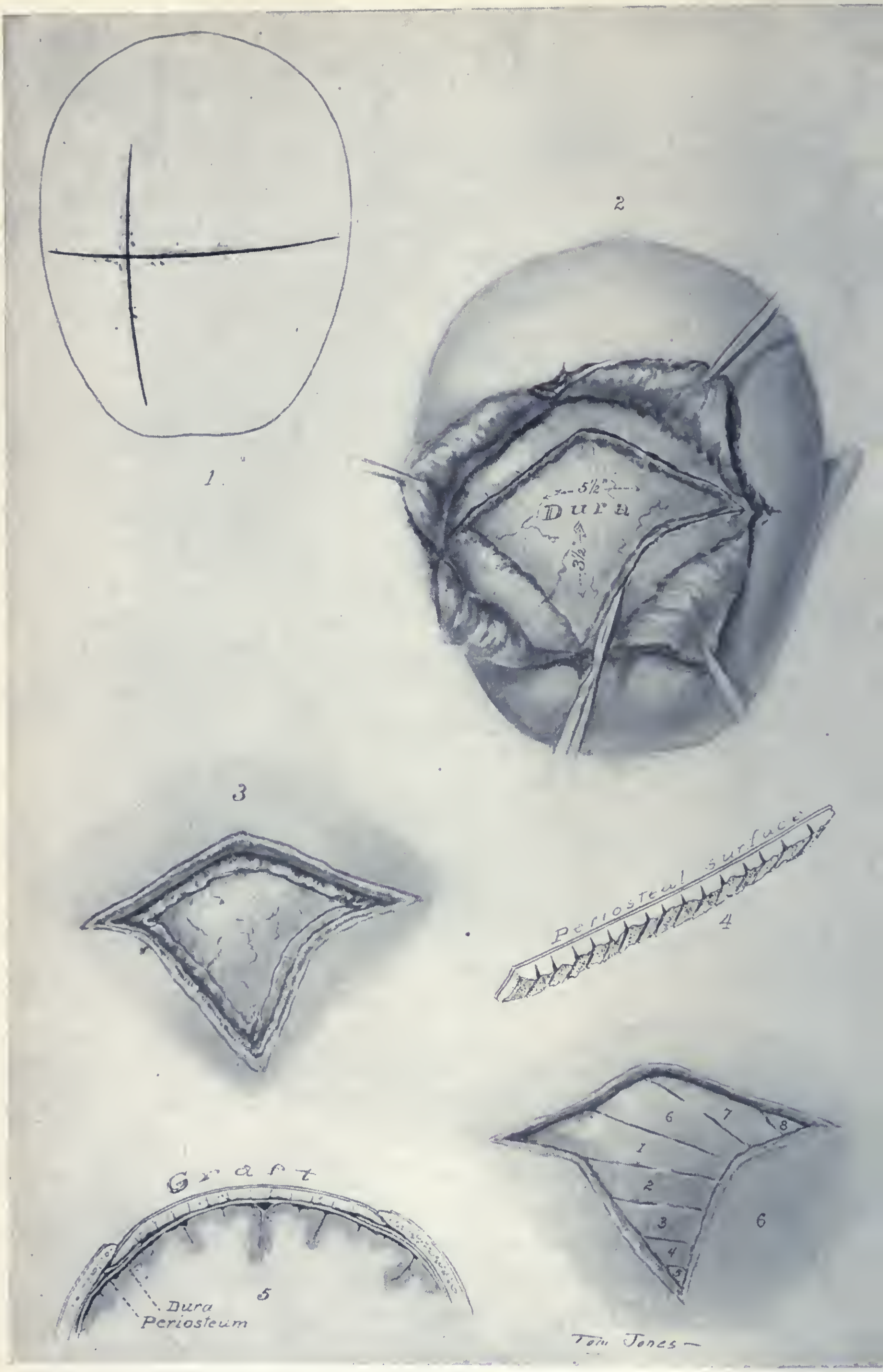

1
2
5½"
Dura
3½"
3
Periosteal surface
4
Graft
5
Dura
Periosteum
6
7
8
1
2
3
4
5
6
Tom Jones—

Fig. 267.

the graft must be bent. To accomplish this it is necessary to cross-cut the graft in many places with the rotary saw. One cuts from the fresh side of the graft through nearly to the periosteum (Fig. 267, 4). This, carefully done, gives you a graft which is easily bent, yet is sufficiently strong and still has an intact periosteum. With the first graft in place, a second is planned, marked out, and cut exactly the same as the first, and so on until the entire defect is closed with grafts which fit exactly. In this case we cannot get enough grafts from the one tibia, and it will be necessary to open the second one. It requires in all eight grafts varying in length and shape according to the space each is to close (Fig. 267, 6). Care is taken to see that the ends of the graft fit securely into the space between the periosteum and the denuded free edge of the cranial bone. A cross-section is shown in Fig. 267, 5. For the purpose of illustration the dura and periosteum are shown as two layers. One prefers to place the periosteal side of the graft inward, that is, periosteum to dura, but in this case it is necessary to place some of them in the reverse manner because of the great size of the defect and the difficulty in securing enough grafts. With the grafts accurately in place the scalp flaps are closed without drainage and a paraffin gauze dressing applied. The incision over the tibia is closed by my assistant while I close the scalp wound. Casts are applied to the leg and the patient returned to his bed in fair condition.

During ten months Villandre personally operated on 106 cases of loss of cranial substance. The procedures employed were:

1. Cartilaginous cranioplasty.
2. Osteoperiostic grafts taken from the tibia.
3. Sterilized bone plaques.
4. Paste composed of carbonate and phosphate of lime for small breaches.

The author indicates the various types of lesions in which

Fig. 267.—1, Incision for exposure of defect. 2, Defect exposed; incision for exposure of raw bone surface at margin of defect is partially completed. 3, Defect ready to receive transplants. 4, Method of cross-cutting graft to render it malleable. 5, Cross-section showing relations of graft when properly placed. 6, Grafts in place, the next step will be the closure of the scalp wound.

these methods are used. The statistical results of the four procedures were as follows:

Osteoperiostic grafts, 32 successes in 32 cases, or 100 per cent.

Cartilaginous cranioplasty, 46 successes in 48 cases, or 96.8 per cent.

Sterilized bone plaques, 18 successes in 22 cases, or 81.8 per cent.

Lime paste, 2 successes in 4 cases, or 50 per cent.

A graft of living substance, bone, or cartilage removed from the patient himself and at a distance from the site of the loss of substance is, therefore, the most practical and the surest method of repairing a loss of substance. Such reparations are relatively without danger when they are made by a surgeon operating under rigid conditions of asepsis. Of 106 cases operated upon there was not a single death.

Free bone lives and is more frequently to be employed, displacing inorganic materials which have been formerly relied upon. The method of free grafts dates from the experience of Ollier in 1865.

The advantages of bone-graft over metal and celluloid plates are:

1. The bone lives, and eventually becomes part of the skull.
2. It does not cause irritation or act as a foreign body.
3. An excellent effect is produced on the patient mentally.

Bone has the advantage over cartilage in that it retains its hardness and is as efficient a covering for the brain as the skull. Leriche and Policard have recently reported upon microscopic examination of cartilage implanted to close cranial openings, the one case operated thirty-six days and the other one year previously. The cartilage proper in both cases had disappeared and been substituted by connective tissue.

Gilmour, of Toronto, working in a Canadian Hospital at Orpington, England, reports that in 2 of his cases in which he used cartilage examined after five months the graft had softened and did not give the same amount of protection as did bone.

He wishes to draw especial attention to the following benefits from operative procedures to close cranial defects:

1. Depression leaves, the patient becomes optimistic and bright.

2. Headaches improve in all cases, entirely disappear in most cases.

3. Memory improves, dizziness disappears.

4. Eyesight improves, the blurring of vision disappears, and the color fields increase.

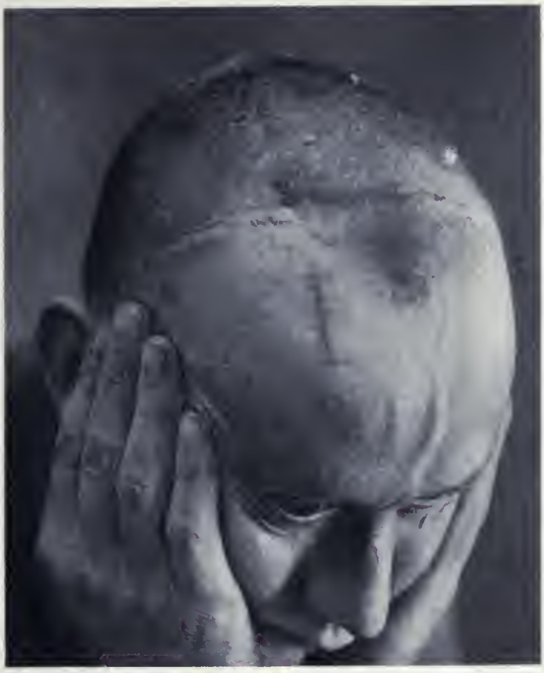


Fig. 268.—Appearance of operated area ten days following operation.

5. The patient ceases to be a permanent ward of the state and becomes a useful citizen, capable of carrying on an ordinary occupation.

Note.—This patient made an entirely satisfactory convalescence. Was up in wheel-chair at end of the first week, and since the third week has been walking about. At the end of the third week the grafts were all firmly healed in place. There is no longer any pulsation. There has been complete disappearance of the "trephine syndrome." The patient is no longer depressed

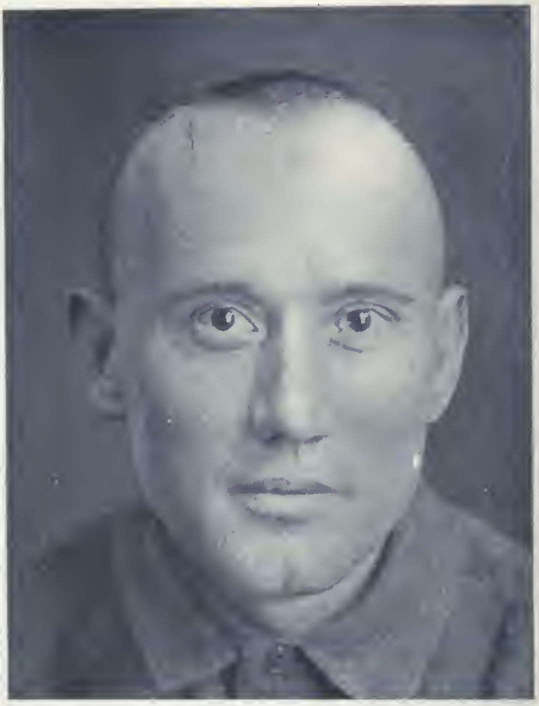


Fig. 269.—After operation. Front view, showing restored contour of head.

and is now taking an active part in all ward activities, feeling himself to be entirely well (Figs. 268, 269).

TIBIAL TRANSPLANT FOR UNUNITED FRACTURE

Summary: Technic of repair of ununited fracture of both bones of the leg by the Hoglund method.

The patient is D. G., private, 521st Motor Transport; age twenty-six, white, American by birth. Previous occupation, farming.

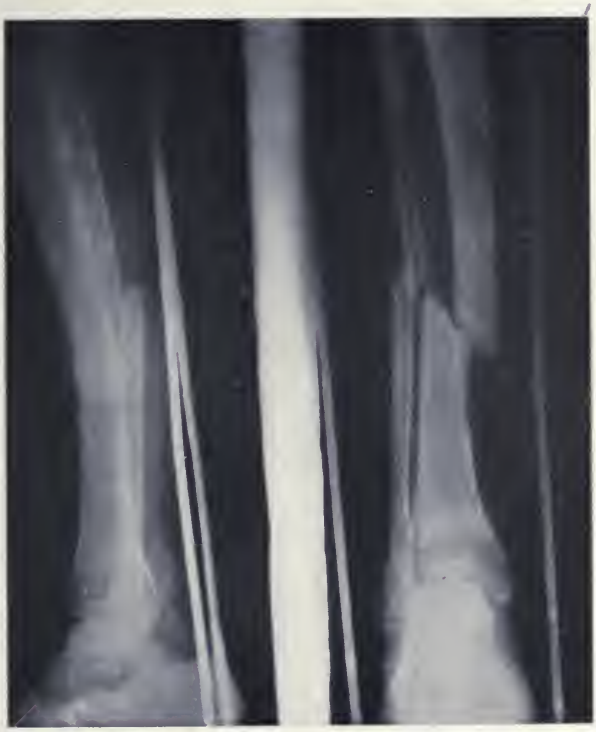


Fig. 270.—Position of ununited fracture on admission to hospital.

Early History.—Measles, mumps, and small-pox.

Past History.—Typhoid at age of twenty; appendicitis at age of eighteen.

Venereal History.—Denied.

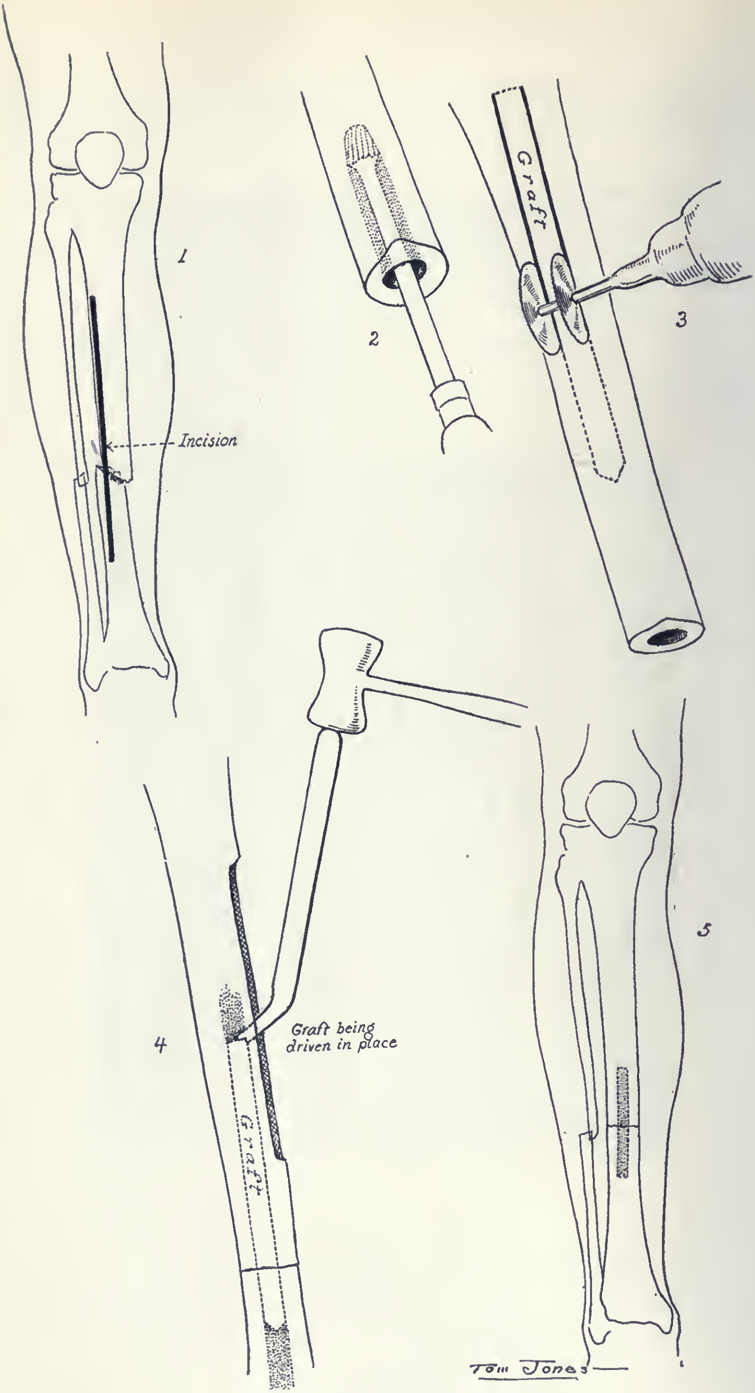

1
Incision
2
Graft
3
Graft being driven in place
4
Graft
5
Tom Jones

Fig. 271.

Present History.—While unloading crated truck at Bordeaux December 30, 1918, patient fell 15 feet, suffering a compound fracture of left tibia and fibula in the lower third, also a dislocation (subglenoid) of the head of the humerus, left, with fracture of the tuberosity, and injury to the brachial plexus.

Following reduction of dislocation the injury to the brachial plexus has cleared up with gradual return of both motor and sensory function. Patient entered General Hospital No. 28 March 28, 1919, as a litter patient, with fracture of tibia and fibula ununited, as shown by accompanying *x*-ray (Fig. 270). The wounds to the soft parts of leg have been healed since January, but there is no attempt at bone union.

Operation.—Incision 10½ inches in length is made along crest of left tibia (Fig. 271, 1). The incision is so planned as to give ample exposure of both upper and lower fragments. The ends of both upper and lower fragments are freed and turned out of wound and the marrow cavity of both fragments reamed out to a distance of 2 inches. For this purpose we used the reamer attachment of the Albee motor-driven bone outfit (Fig. 271, 2). In doing this autogenous tibial transplant we are using the method described by Emil Hoglund, of Chicago. This he published in Surgery, Gynecology, and Obstetrics, February, 1917, and is a most excellent adaptation of the intramedullary graft. Having completed the reaming out of the marrow cavities, we lay aside our reamer and attach the twin saws. The upper fragment being much the longer, we cut from its anterior surface a 4-inch graft, the lower end of which is 2 inches above the lower end of the upper fragment and the width of which is planned to match the size of the reamed-out medullary cavity (Fig. 271, 3). The graft is next cut free at its upper and lower ends, but not removed. The graft is now readily pressed inward so that it occupies the underlying medullary cavity, and is ready to be driven downward into the reamed-out portion of the medullary cavity of both upper and lower cavities. Before doing this, however, it is necessary to

Fig. 271.—1, Incision for exposure of fracture. 2 to 5, The bone-marrow is reamed out, a graft cut from the tibia 2 inches above site of fracture, and driven down across fracture line.

bring the two fragments into proper alignment. This is readily done by traction. They may be held in proper alignment either by the large bone forceps or by means of a Lowman clasp. The graft which now lies in the medullary cavity of the upper fragment may very readily be driven downward into the position where it bridges the point of fracture (Fig. 271, 4) and extends for a distance of approximately 2 inches into the marrow cavity of both upper and lower fragments (Fig. 271, 5). Hoglund has also devised a special instrument which is of great service in driving the splint downward through the canal across the line of fracture (Fig. 271, 4). The wound is then closed by interrupted sutures and a plaster cast applied to the leg (Figs. 272, 273).

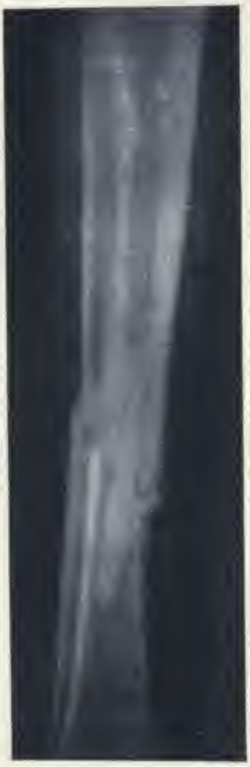


Fig. 272.—*x*-Ray after operation. Lateral view, showing graft.

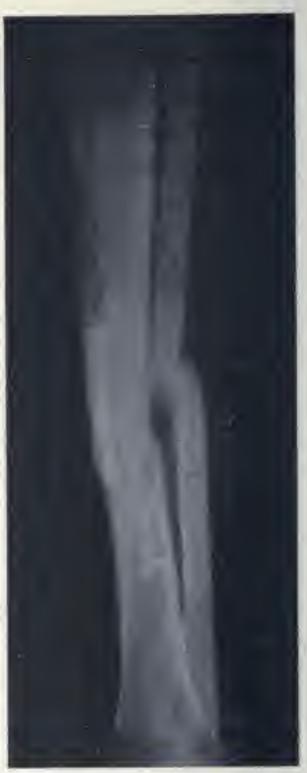


Fig. 273.—Anteroposterior view, showing intermedullary graft in place.

The original feature of this operation is the method of cutting the graft at a distance of from 1 to 2 inches from the line of fracture, so as to leave a complete ring of bone at the fractured end, thus contributing enormously to the strength of the union. This makes the strongest and at the same time most accurate mechanical fixation of which I know. Its advantages and its ease of application recommend it as the operation of choice in most of the cases of ununited fractures in long bones.

Note.—This patient made an entirely satisfactory convalescence. Wound healed by primary intention. At the end of the fifth week, on removal of the cast, there was complete union. The patient could, unassisted, lift the leg free from the supporting pillow. A new cast was applied, which was left on another four weeks. It is important to keep these bones immobilized longer than would ordinarily be the case because of the atrophy of disuse that is always present in these old fracture cases.

LEFT INGUINAL FECAL FISTULA

Summary: Gunshot wound of rectum with resultant fecal fistulæ in both hips; inguinal colostomy for cure of wound fistulæ with resultant persistant fistula in colostomy wound; technic of operation for cure of inguinal colostomy.

THIS patient is twenty-five years of age, single, by occupation a cabinet-maker, and American by birth.

Family History.—Father's age fifty-eight; good health; Mother's age fifty-nine. Two brothers living; three brothers died in infancy; two sisters living.

Early History.—Diphtheria at age of nine; many attacks of tonsillitis.

Past History.—Negative except for double pneumonia in August, 1917, at Camp Logan.

Venereal History.—Had gonorrhea in 1914.

Habits.—Occasional glass of beer; tobacco moderately.

Present History.—On September 26th in Forges Woods near the Meuse River he received a machine-gun bullet wound, passing through the pelvis in a lateral direction. The wound of entrance was 3 inches back and 1 inch up from the left great trochanter; the wound of exit 4 inches directly back from the right great trochanter.

Operated October 6th at Base Hospital No. 15. Between date of injury and date of operation he had had several hemorrhages from the rectum, and fecal matter was being discharged from both wound of entrance and exit. The operation was evidently a left inguinal colostomy. Following colostomy the left buttock wound closed within six weeks and the right wound closed in about four months, but opened again within three weeks. Remained open for two weeks and then closed, remaining closed up to the time of entrance to this hospital.

Entered General Hospital No. 28 March 24, 1919, in good physical condition except for ventral hernia at site of operation for colostomy, with colostomy wound still open, discharging fecal matter. Fascial defect giving rise to ventral hernia is 4 inches in length, 1 inch in extreme width. The original perforation which gave rise to the fecal fistula through buttocks evidently was in the rectum and postperitoneal, since, from the history, we can get no evidence of the patient ever suffering from a peritoneal infection.

The object to be obtained by previous operation evidently was the creation of a comparatively simple inguinal fistula which would encourage the closure of the two fistulæ lower down. In this it was entirely successful.

Operation.—On April 7, 1919, the patient was anesthetized. The fistula was closed with three silk stitches, the operating field then sterilized with benzine, iodin, and alcohol. A curved incision following the mesial border of the fascial defect was made; this cleared the intestinal opening by approximately $\frac{3}{4}$ inch. The flap thus freed was turned outward, the peritoneal cavity opened along the same line. All adhesions freed and bowel dissected loose from abdominal wall. The scar tissue about edges of opening closed in the usual manner. The bowel dropped back into abdomen. Peritoneum closed. Abdominal wall closed in layers, each layer having been previously dissected free. Muscle edges approximated with No. 1 catgut sutures lightly tied. Fascial layers overlapped, No. 3 catgut suture material being used. Skin closed without drainage. Patient's convalescence was uneventful; he was allowed out of bed during third week. This case is of interest because of the unusual site of the intestinal perforation and resulting fecal fistulæ, and the use of the very good idea of an inguinal colostomy to encourage the closure of the fistulæ lower down.

CLINIC OF MAJOR D. B. PHEMISTER

U. S. General Hospital No. 28, Fort Sheridan, Illinois

REPARATIVE SURGERY OF WAR WOUNDS OF BONE AS ILLUSTRATED BY FRACTURES OF THE FEMUR

Summary: Chronic infection, long-standing malposition, and partial or complete interruption of continuity the chief problems to be met, the first problem overshadowing all the rest; pathologic anatomy of chronic posttraumatic bone infections; methods of examination; obliteration of dead spaces and removal of sequestra the chief essentials in treatment, Dakin's solution playing a secondary relatively non-essential rôle. Demonstration of illustrative cases.

The care of the wounded in the hospitals of this country as they have been returned from overseas has presented different problems from those encountered in the earlier work in the same type of cases on the other side.

In the case of fractures the important problems arising during the stage of splinting and acute infection about the seat of the fracture have largely passed, as months have usually elapsed since the injury, and healing is either well under way or completed, and well-developed sinuses have been established where infection persists, allowing of discharge of pus and limiting abscess formation to a small percentage of cases.

The problems presented are largely those of chronic infection, long-standing malpositions, and partial or complete interruption of continuity resulting from loss of bone substance. By far the most important of these is persistent infection with its consequent fistulæ and discharge. It is the sequel of the acute infection which occurs at the time of the injury, and leads to the formation of a variable amount of dead bone and to alteration in the callus. The fractures are usually comminuted, with a number of large or small splinters and sharp, irregular, pointed fragment ends. Necrosis of the splinters is common, especially when they are completely detached. Frequently only portions of adherent or detached splinters die. Death of the ends of the fragments is apt to occur, especially when pointed, but also along the margins of the oblique fracture lines. Reparative processes soon begin in the surviving elements of the ends of the fragments and splinters, and lead to callous formation which has the usual features of callus formed in the presence of infection and about dead bone. Destructive changes are set up about the dead bone which lead to its gradual separation from the living bone and the formation of a variable number of sequestra. Unless the destruction of osteogenetic elements has been too extensive the newly formed bone usually leads to bony union in from two to five months in case of the larger bones. The pieces of dead bone come to lie in pockets or cavities surrounded by masses of exuding granulations which continue to exert more or less absorbtive action on them. If the dead bone is pocketed where the granulations have a better chance for attack the absorption may be considerable and continued irregular reduction in size will occur. But if it lies in larger open spaces and is bathed continuously in the pus of discharging deeper portions, the surrounding granulations will be less healthy and destruction may be very slight, especially in the case of a large dense piece of cortex.

The new bone bridging the fracture is irregular in its distribution according to the location of the dead bone and the cloacæ which form for the escape of the discharge. There are usually one or more cavities, pockets, or windows along the lines of the fracture which have resulted from the formation of dead bone and the failure of the callus to fill out the defect in these regions.

The dead fragments may be gradually broken up, extruded, or absorbed as time goes on, in which event the rigid walled sinuses usually remain and are filled with granulation tissue which contains bacteria and fails to be converted into scar tissue, thus keeping the sinus open. Frequently the cavity is very irregular, extending obliquely along the fracture line, with several arms and openings. Tunnel formation is very common from the presence of a cavity in the medullary region with an opening on either side.

The callus, as a rule, gradually organizes and does not present evidences of chronic infection after the dead bone has been separated and the sinuses and cavities have been definitely established. Consequently, the main causes of persistent infection with continuous or intermittent discharge in the type of case which is seen months after injury are dead bone and cavity, tunnel and pocket formation at the seat of fracture. More or less disseminated infection of the callus may be occasionally responsible, but it plays a relatively minor rôle.

Rational therapy in the old cases is based almost entirely upon the recognition of dead bone and its removal, and the presence of abscess cavities, pockets, and tunnels and their effacement by the sloping removal of a sufficient amount of the surrounding new or old bone to allow the soft parts to fall in and fill out the space.

It is rare to find either new or old living bone so extensively infected that removal of large amounts for this reason is necessary. Combined clinical and roentgenologic study will usually give one the desired information as to the presence and extent of these conditions, and the type of operation can be planned before the bone is exposed. Occasionally both the amount of dead bone and the extent of cavity formation will be far in excess of expectations, and a different plan of procedure has to be resorted to after the exploration. The incision or incisions are so placed that periosteum and soft parts are removed as nearly as possible only from that bone which is to be excised. This prevents infection and subsequent death of unnecessarily denuded bone which is left.

If the callus is sufficiently strong to permit of the removal of the dead bone and the effacement of cavities and tunnels at the same operation, this is always done, but if the removal of the necessary amount of bone would leave a too much weakened bridge and lead to fracture or danger of non-union, the dead bone alone is removed and the effacement operation postponed to a time when the bone which is to remain is sufficiently strong.

Foreign bodies, unless very large, are usually encapsulated in the surrounding soft parts and are not the cause of the fistulæ in marked contrast to the dead bone. This is because they are sterile on the inside and easily become encapsulated, while dead bone, being more or less porous and harboring bacteria, usually keeps up continuous suppuration. Such foreign bodies as communicate with the fistulous tracts or are large and accessible are removed. If small and encapsulated they are usually not molested.

Careful splinting or the application of a cast is essential where the bone has been much weakened. Operation with the limb in a Thomas splint is still advisable in certain cases months after the injury. Radical operation should never be attempted in the presence of an acute exacerbation.

The wound in the soft parts is usually left open and packed loosely with gauze. Partial closure may be made where the amount of infection is slight, but, as a rule, this is unsafe.

Wound healing occurs somewhat more rapidly and certainly with the use of the Carrel-Dakin technic, which is the routine after-treatment, but it is of minor importance in comparison with the operation, and healing occurs without a very striking difference when dry dressings are used.

The following cases are illustrative of some of the conditions with which one has to deal in fractures of various portions of the femur:

Case I.—Private A. M., wounded August 10, 1918, by high explosive entering in the left sub- and supratrochanteric regions, fracturing the upper end of shaft of femur and perforating the ileum above the acetabulum. Wound debridement in thirty hours. Treated in Base Hospital with limb in Thomas splint for ten weeks; then in plaster-of-Paris cast for three months. Considerable discharge from both wounds, especially from upper. Patient was septic, lost weight, and ran a continuous temperature. Cast removed in January, when fracture was healed. Operation February 15th for removal of dead bone from femur. Continued to run temperature and have discharge until admitted to U. S. General Hospital No. 28 in April.

At that time he was emaciated and moderately septic. The left thigh was markedly deformed about the hip and 2½ inches shorter than the right. There was a fistula leading down to the subtrochanteric region of the femur and a larger one with much discharge in the supratrochanteric region. A probe could be passed inward along this backward tract through the iliac bone into the pelvis. Pelvic examination revealed a tender mass on either side of the rectum above the levator ani. There was slight mobility in the hip-joint.

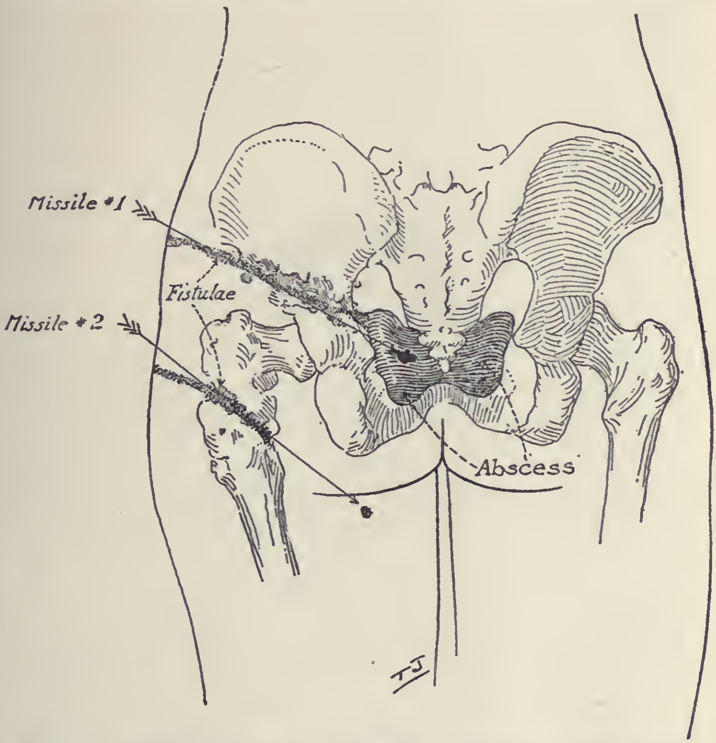


Fig. 274.—Sketch from *x*-ray, showing fractures, tunnels, fistulæ, and foreign bodies, with abscess in pelvis draining incompletely through the upper fistula.

x-Ray examination showed a healed left subtrochanteric fracture with marked abduction of the upper fragment and irregular callus at the seat. No tunnel was seen in the *x*-ray. Questionable sequestrum shadow was present on the internal surface of thigh 3 inches lower down. There was a streak of lessened density extending obliquely downward through the ilium in the region of the fistula with surrounding new bone formation. The shadow of a foreign body appeared 2 cm. internal to the ischial spine which on localization proved to be 7 cm. from the rear. Figure 274 is a sketch from the *x*-ray and also shows the pelvic abscess.

Operation (*April 18, 1919*).—Posterior perineal incision centering over ischial spine. Large horseshoe-shaped abscess opened about rectum and between levator ani muscle and pelvic peritoneum (Fig. 275). Foreign body found in abscess cavity and extracted. This abscess, which was of months' standing and lined with a pyogenic membrane, communicated with and drained imperfectly through the fistula, penetrating the ilium and opening on to the supratrochanteric region.

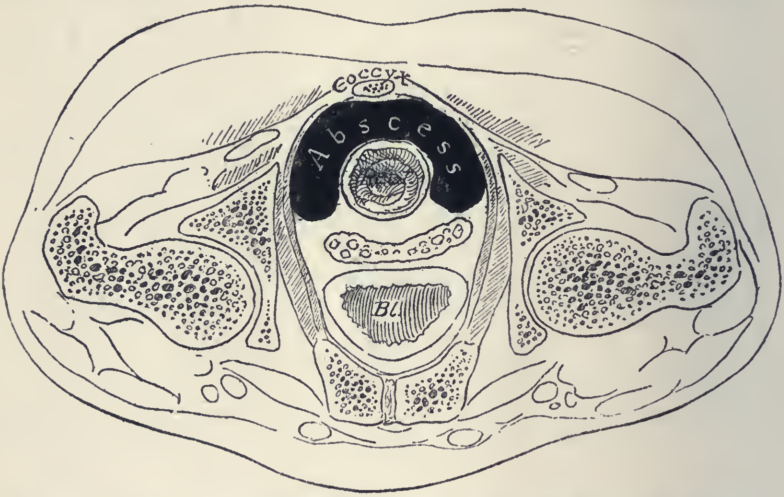


Fig. 275.—Relation of abscess between levator ani and pelvic peritoneum to rectum.

Lateral incision was made, exposing seat of fracture in femur; tunnel through callus from anteromesial to posterolateral portions discovered; large ledge chiseled off about opening of tunnel anteriorly and sequestrum removed from its posterolateral opening.

Because of patient's poor condition the further radical operation necessary for the obliteration of the tunnels through the ilium and the femur was not performed.

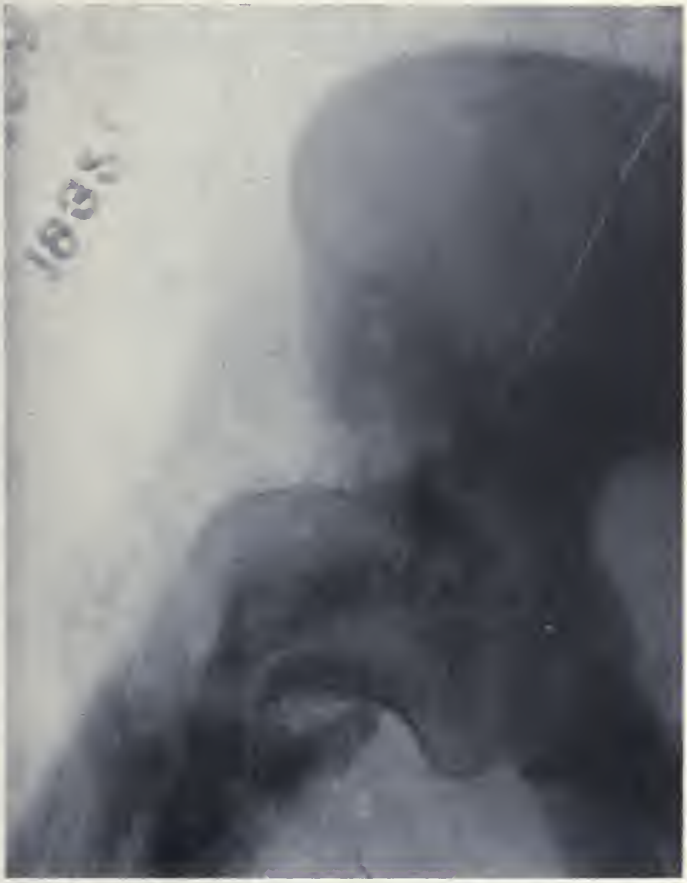


Fig. 276.—Ilium and femur one month after operation.

Postoperative.—The patient's general condition markedly improved, and now at the end of six weeks the sinuses have closed, both laterally and posteriorly (Fig. 276). However, he has run an afternoon fever of 1 to 1½ degrees most of the time, which probably means that infection is still present in the course of the tunnels through the ilium and femur, which may lead to re-establishment of the fistulæ and necessitate further operative interference for their obliteration. In the case of the femur the removal of the weaker anteromesial wall would be indicated; in the ilium, extensive removal of the external wall, leaving a crater-shaped defect into which the gluteal muscles can sink.

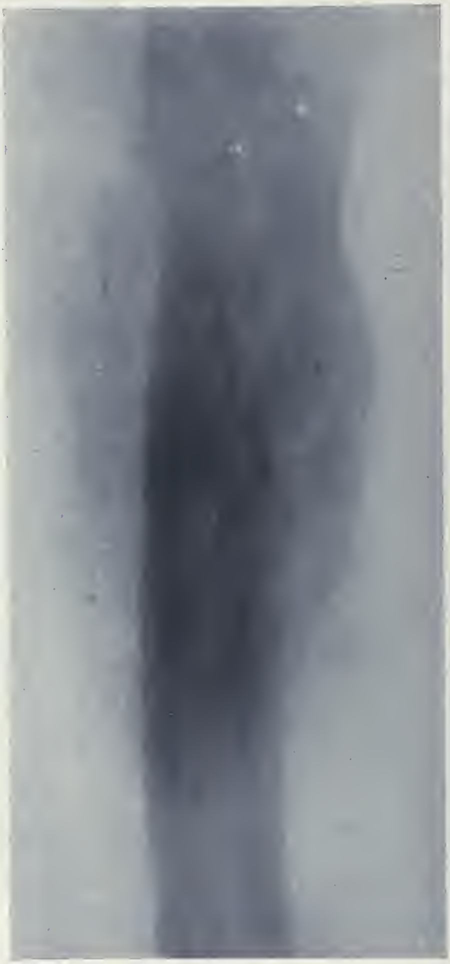


Fig. 277.—Side view of healed oblique fracture of upper end of femur with numerous sequestra.

Case II.—Private J. A., injured by machine-gun bullet September 27, 1918, sustaining a fracture in the subtrochanteric region. Debridement sixty hours after injury. The limb was kept in a Thomas splint for six and one-half months until healing was complete. The wound in the soft parts healed except for a sinus laterally, which continued to discharge profusely. Dakin's solution through an enlarged opening was used for two and a half months before admission, April 12, 1919, but did not modify the condition. *x*-Ray (Fig. 277) side view taken April 15, 1919,

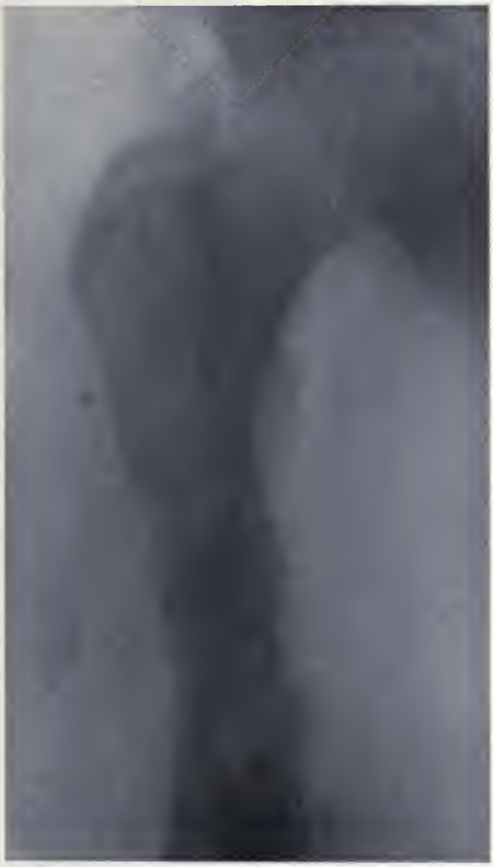


Fig. 278.—Condition of fracture shown in Fig. 277 one month after operation.

shows the type of fracture. There is a very oblique fracture line with shadows suggesting sequestra and lessened density, suggesting a tunnel running obliquely downward and backward across the bone.

Operation (*April 16, 1919*).—Lateral incision, exposing outer and anterior surfaces of seat of fracture; there are cloacæ anteromesially, laterally and posterolaterally, and a tunnel extending along the oblique fracture-line connecting them; sloping removal of the anterolateral wall of the tunnel which was found to contain seven sequestra of varying sizes; the soft parts could then fall in and fill out the defect. The remaining posterior bridge was sufficiently strong to support the limb.

Postoperatively, with Carrel-Dakin treatment, the exposed wall of the tunnel and the remaining cut surfaces soon became covered over with granulations, and at the end of seven weeks the wound is healed except superficially. Figure 278 shows *x*-ray of the remaining bridge of bone.

CASE III.—Private H. On July 30, 1918, sustained comminuted fracture of left femur 4 inches below trochanter from high explosive shell. Debridement twenty-four hours later. Treated with Thomas splint for five months, when healing was complete, but discharging sinus persisted. Operation February 1, 1919, for removal of dead bone, but sinus persisted.

Upon admission to General Hospital No. 28, April 12, 1919, there was union with 1½ inches of shortening, and a discharging sinus on the anteromesial and the lateral sides of the thigh at the level of fracture. *x*-Ray (Fig. 279) showed union with marked irregularity and evidence of dead bone at seat of fracture; large foreign body in soft parts mesial to fracture and several smaller fragments lower in muscles of thigh.

Operation (*April 17, 1919*).—Lateral incision exposing seat of fracture. There is a deep groove with dead bone and overhanging ledge along posterior surface of callus and extending obliquely downward along fracture line. A probe leads on posterior surface of femur through sinus on mesial surface of thigh, where foreign body can be felt. Figure 280 shows relation of sinuses to dead bone, groove in callus, and the upper foreign body. Posterior walls of groove and sinus in bone removed and dead bone extracted. Foreign body in fistula extracted through enlarged anterior opening. All of the other foreign bodies were encapsulated and were not disturbed.

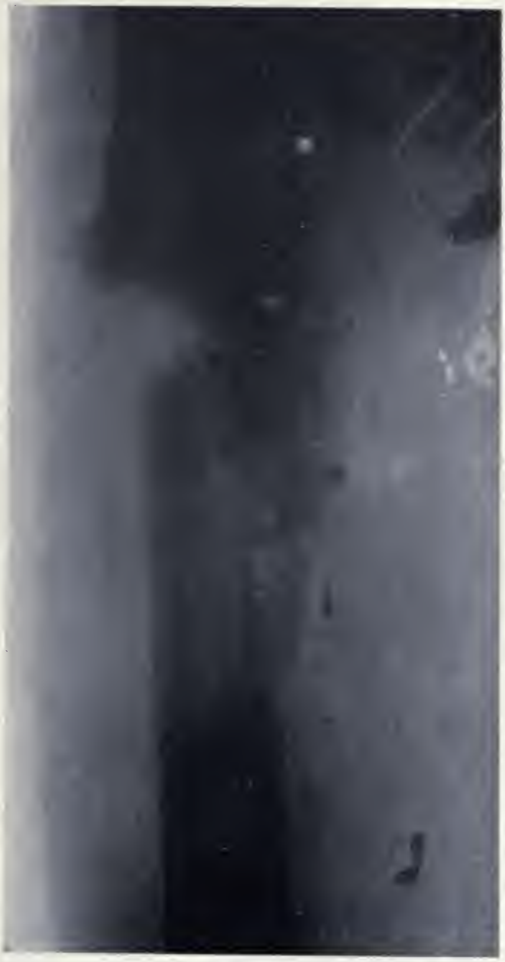


Fig. 279.—Fracture healed, with sequestrum and foreign bodies in vicinity.

Wound healing has been rapid and in five and a half weeks the opening down to the bone was closed. There is still a small fistulous tract leading down to the former seat of the foreign body. This is suggestive that there may be a bit of clothing which was not removed at the operation, as it is a not uncommon cause of fistulæ following removal of foreign bodies.

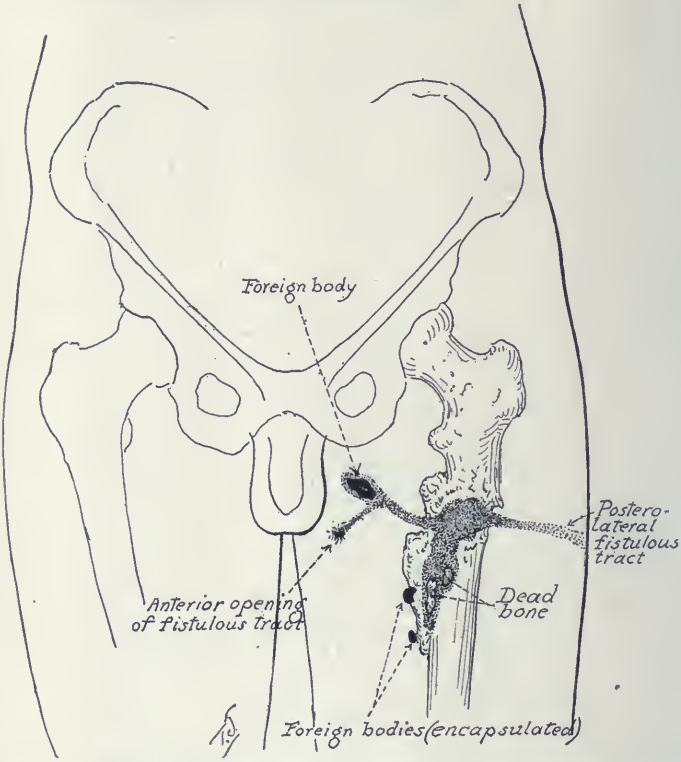

Foreign body
Postero-lateral fistulous tract
Anterior opening of fistulous tract
Dead bone
Foreign bodies (encapsulated)

Fig. 280.—Outline of fistulous tract communicating with sequestra and upper foreign body.

Case IV.—Lieut. M., wounded by machine-gun bullet September 28, 1918, which fractured the middle of the right femur. Debridement forty hours later. Thomas splint applied. Wound suppurated badly and patient was anesthetized for drainage operations a number of times during the subsequent four months. Discharge continued and union was incomplete when patient was admitted to the U. S. General Hospital No. 28 March 10, 1919, wearing a Thomas splint.

Examination showed $2\frac{1}{2}$ inches of shortening of right femur, and x-ray examination (Fig. 281) showed imperfect union and position with three large pieces of dead bone at the seat of fracture, and two fragments of the machine-gun bullet embedded in the soft parts anteriorly.

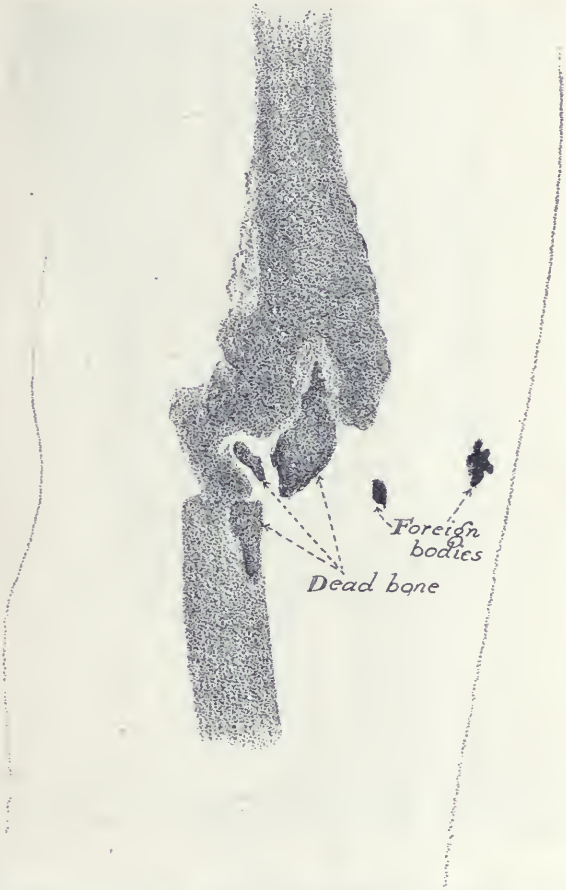


Fig. 281.—Sketch of x-ray (side view) showing malunion, sequestra, and foreign bodies six months after injury and preceding operation.

Operation (*March 18, 1919*).—With limb in Thomas splint the anterior opening was enlarged and a posterolateral longitudinal incision made down to bone. Three sequestra removed from the suppurating seat of fracture. Foreign bodies in soft parts were encapsulated and had no connection with the sinuses. The smaller one was located and extracted, but the larger one could not be found. Wound packed and dressed with dry dressings. In five weeks both wounds were healed, but the fracture was not yet solid, as shown by manipulation and another *x*-ray (Fig. 282). The patient was then placed on a Hawley table and a body and leg cast applied, since which time he has been getting about on crutches. The cast will be removed at the end of three

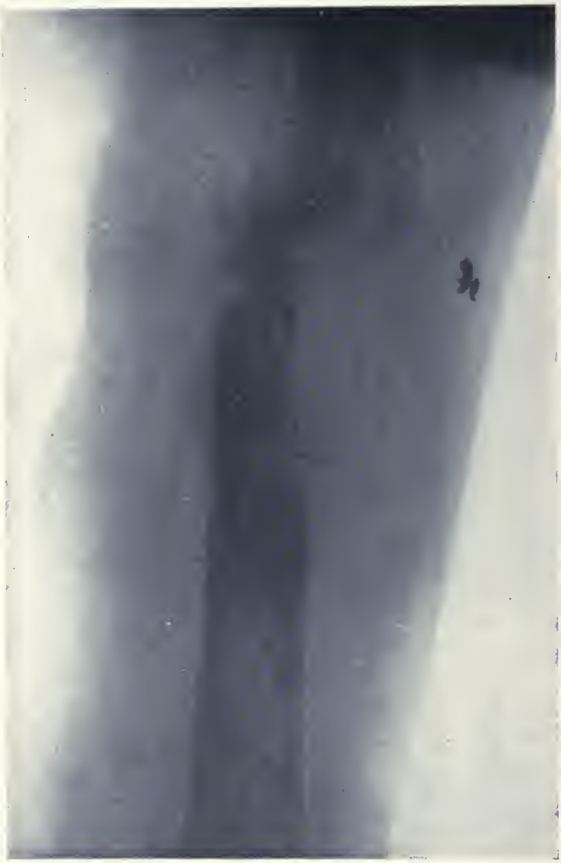


Fig. 282.—Five weeks after operation. Wound healed after removal of sequestra despite presence of foreign body in neighboring soft parts.

months and the limb re-rayed. If after several months the bridge of bone does not hypertrophy sufficiently to support the limb, a heavy bone transplant from the tibia will be inlaid into either fragment, making a reinforcing bridge for the gap.

Fig. 283.—Healed fracture of femur with large cavity opening from side.

Case V.—Private E. P. received a high explosive fracture of the middle portion of the right femur July 18, 1918. Debridement July 20, 1918. Treated in Thomas splint for six months until fracture healed. Was operated on three and seven and a half months after injury for dead bone.

On admission to U. S. General Hospital No. 28, April 1, 1919, there was a large discharging wound on anteromesial surface of thigh about seat of fracture. *x*-Ray examination (Fig. 283) showed a healed fracture of the femur with spindle-shaped callus along lateral side, and in side view a large opening could be

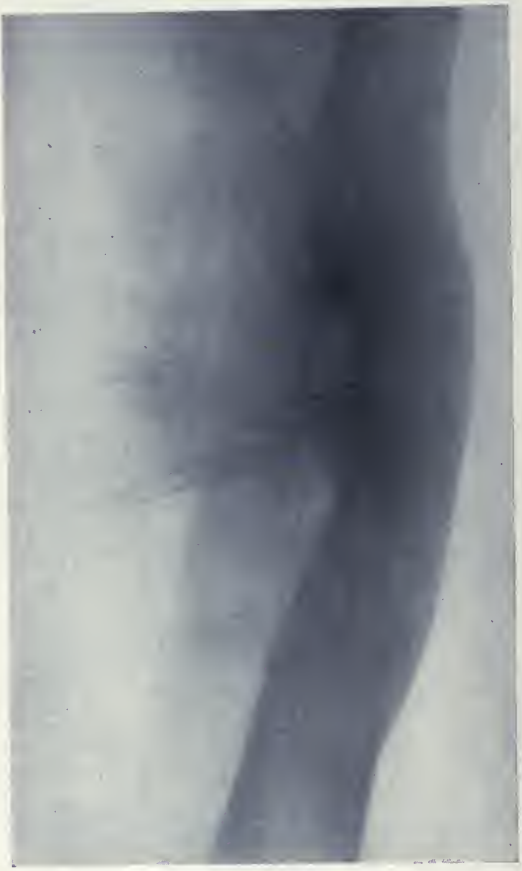


Fig. 284.—After effacement of enough of cavity walls to allow soft parts to fall in (compare Fig. 283).

seen in the mesial side of the bridge. A piece of high explosive shell was present on the posterior side of the lower end of the upper fragment. After the wound leading down to bone had improved and a small sequestrum had been extruded, the bone was operated on May 10th for the obliteration of the pocket. The anteromesial wound was enlarged and bone freed at seat of fracture. There was a large hole in the medullary region lined with healthy granulation tissue. Its walls were extensively removed, especially below and posteriorly, so that the soft parts could fall in and fill out the cavity. There was no fistula leading to the foreign body which was left. Figure 284 shows the condition ten days later.

At the present time, three weeks after operation, the bony surface is almost completely covered with granulations and there is little discharge from the wound. The extent of removal of bone from the mesial side is not apparent in the *x*-ray because of the overlapping of the shadow of the anterior cortex.

CASE VI.—Private J. received a machine-gun bullet fracture of left femur 4 inches above the knee on July 18, 1918. Wound debrided July 20th. Afterward treated in Thomas splint until union completed three and a half months later. Posterolateral sinus continued to discharge up to admission to U. S. General Hospital No. 28, April 18, 1919. No operation had been performed for the removal of dead bone.

x-Ray examination (Fig. 285) showed oblique healed fracture with moderate posterior angulation and lateral displacement of lower fragment. Heavy shadows of pieces of dead bone can be seen extending obliquely along fracture line, the largest one being at the lower end. The side view (Fig. 286) fails to reveal the dead bone distinctly.

Operation (*April 24, 1919*).—Posterolateral incision down to bone showed many dead fragments at lower end of break and a tunnel extending obliquely upward and inward along fracture line. A second mesial incision was made and a cortical opening with dead bone found at upper end of the fracture line. In order to obliterate the tunnel the soft parts were then separated from the bone anterolaterally and a sloping spiral removal of the anterolateral bridge performed. Several more pieces of dead

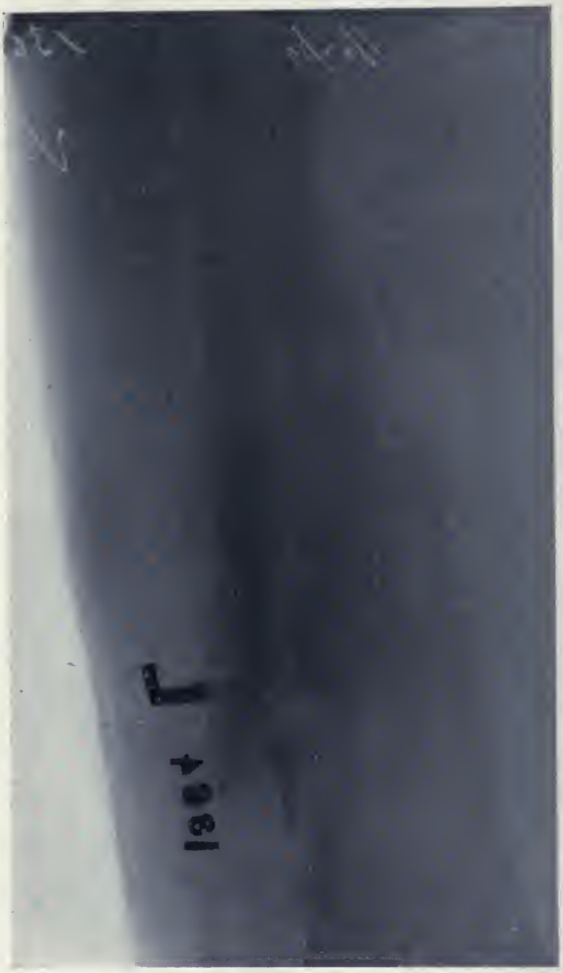


Fig. 285.—Healed oblique fracture of femur with tunnel and sequestra.

bone were then removed from the middle portion of the tunnel. Figure 287 shows the remaining bridge four weeks after operation.

Daily dry dressings were used in the after-treatment. The wounds were healed at the end of five and a half weeks, and the patient is now (June 1st) getting around on crutches. No more striking effect of the removal of dead bone and one wall of a tunnel has been seen than this. Had Dakin's solution been used some would have attributed the rapidity of healing to its action.

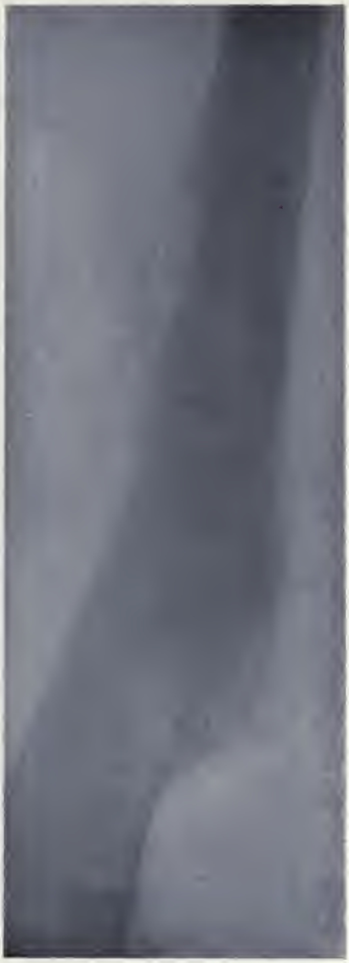


Fig. 286.—Side view of femur (compare Fig. 285).

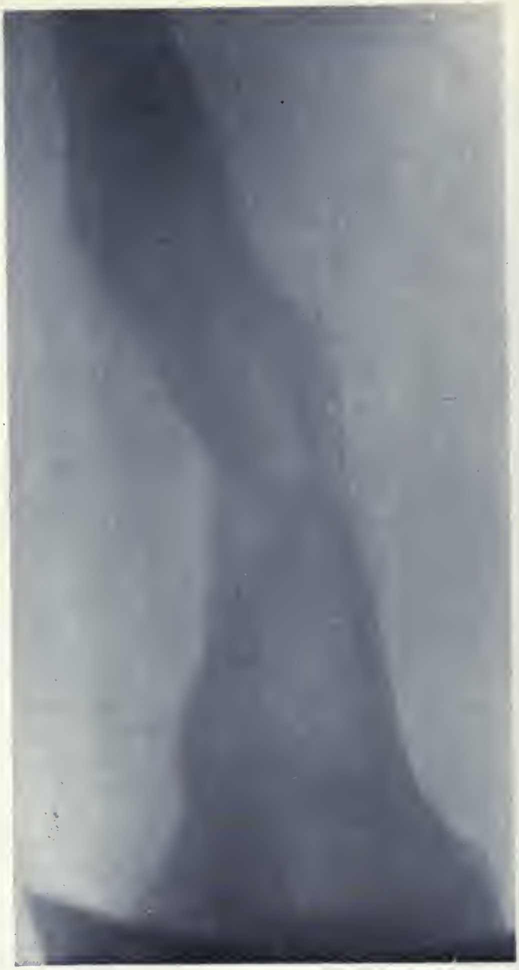


Fig. 287.—After removal of anterolateral wall of tunnel and dead bone.

Case VII.—Private E. wounded September 18, 1918, by machine-gun bullet, entering mesial side and passing out on lateral side of thigh 3 inches above knee, producing a compound comminuted fracture of femur. Wound opened and drained three days later. Thomas splint applied and worn until admitted to hospital, March 5, 1919. No operation had been performed for removal of dead bone, although there had been a continuous profuse discharge from the wound of exit.

Examination showed fracture united by large callus. Dakin tube was inserted in lateral opening.

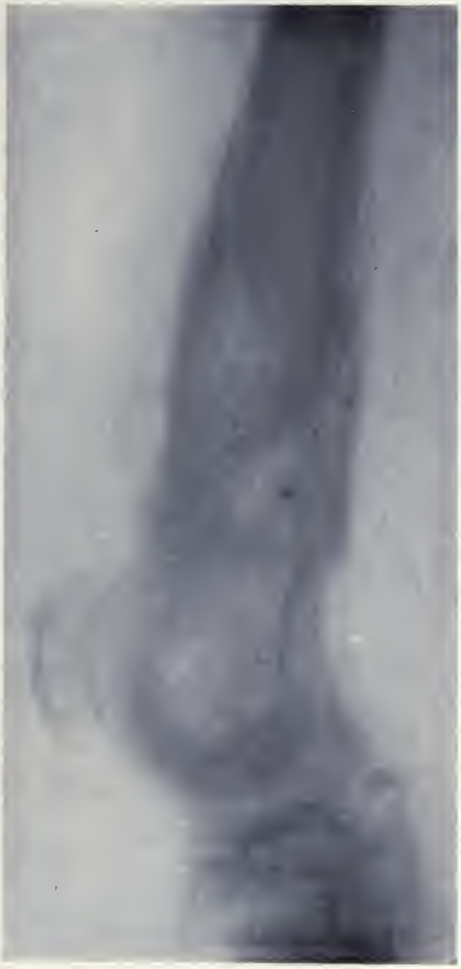


Fig. 288.—Healed fracture of femur, with dead bone and tunnel.

x-Ray (Fig. 288) showed cavity with dead bone in femur 3 inches above joint, with mesial and lateral openings in the newly formed bony ridge.

Operation (*March 18, 1919*).—Long lateral and short mesial incisions down to sinuses. A large lateral window was found in cortex with a cleft running upward along an oblique fracture line. Opening enlarged and several large pieces of dead bone removed from the cavity. Mesial opening slightly enlarged. This left a tunnel transversely through the bone, but neither the anterior

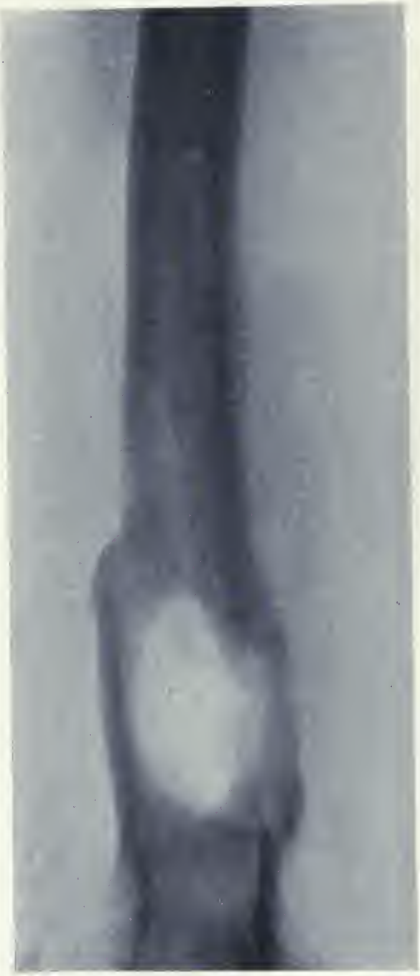


Fig. 289.—After removal of dead bone (compare Fig. 288).

nor the posterior wall appeared sufficiently strong to support the extremity at the time, so both were left and the wound treated postoperatively with Dakin's solution, while the infection cleared up and the bony bridges became stronger. A large portion of the lateral wall of the posterior bridge underwent necrosis from denudation of soft parts and separated in four and a half weeks as a sequestrum, when it was extracted. The entire bony surface then became covered with healthy granulations and discharged very little. Figure 289 shows the tunnel May 3, 1919. The anterior bridge then appeared sufficiently strong to support the limb. Consequently, the posterior bridge was removed May 10th through a slightly curved lateral incision, cutting the soft parts and periosteum along the line of incision in the bone (Fig. 290).

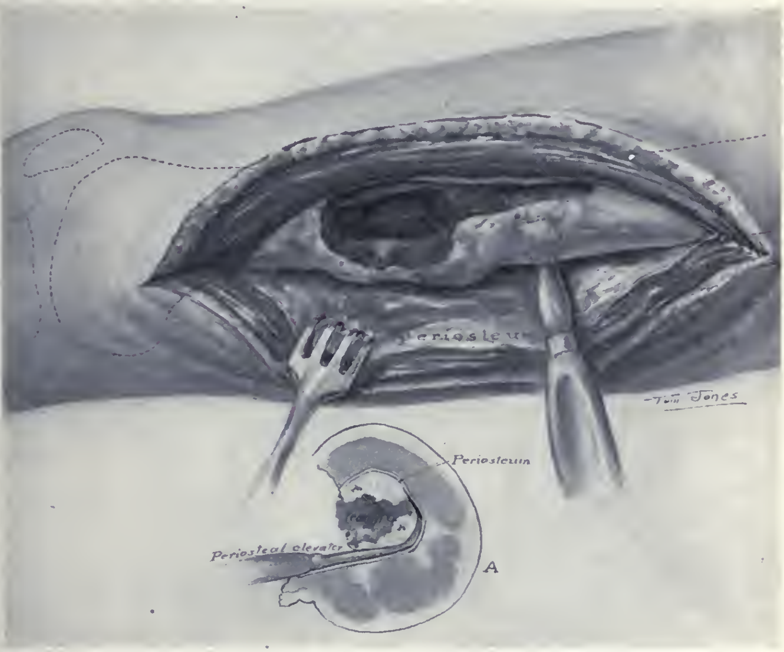


Fig. 290.—Incision and separation of periosteum and soft parts from posterior bridge to be removed. *A* shows in section how curved periosteotome elevates periosteum from bone.

The soft parts were then separated from the bridge around the mesial window with a large curved, sharp periosteotome especially constructed for femur work. The bridge was then removed

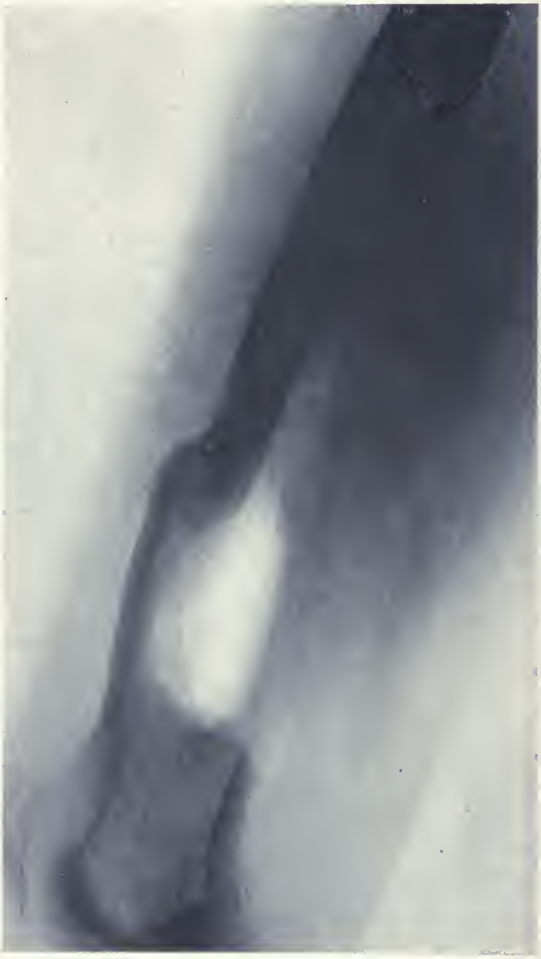


Fig. 291.—After removal of posterior wall of tunnel. (Compare Figs. 288 and 289.)

by a sloping incision at either end which extends through the lateral cortex, across the medullary canal, and through the opposing mesial cortex. This left the condition shown in Fig.

291. The bone incision at the lower end should have sloped more, as it would have permitted the hamstring muscles to fall in more

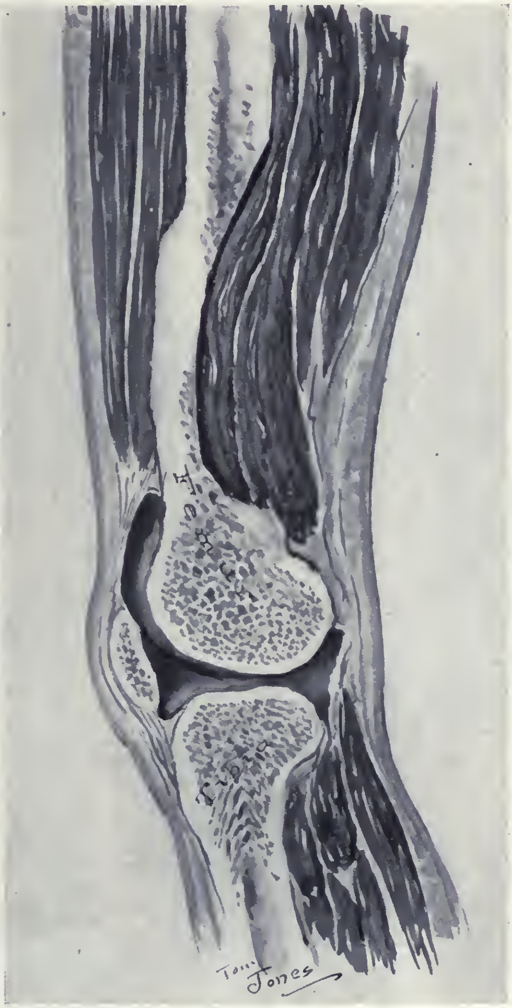


Fig. 292.—Condition to be attained when healing is completed.

easily. The clear spot in the *x*-ray taken May 29, 1919, shows that this has not yet occurred, but the infection has about disappeared and granulations will no doubt pull the soft parts into the defect in the course of a few weeks, as shown schematically in Fig. 292. The anterior bridge is sufficiently strong to support the limb without the aid of a splint, but it will be months before it has increased in size to a point that will permit of full weight bearing.

Case VIII.—Private G., on May 15, 1918, received a high explosive fracture of right femur 3½ inches above knee. Wound debridement in fifteen hours. Body and leg cast applied and wounds dressed through lateral opening. Two months later under ether the fragments were manipulated in an attempt to overcome the shortening and angulation. Plaster cast reapplied. Following this wound was opened several times for the establishment of drainage. In September plaster cast was replaced by Thomas splint, which he has worn since. Operation in December for removal of dead bone. Deformity and sinus have persisted.

Examination on admission to U. S. General Hospital No. 28 April 24, 1919, showed 3 inches of shortening, with upper fragment overriding lower on its outer border. Mobility still present at line of junction. Knee markedly stiffened. Posterolateral sinus leading down to bone. *x*-Ray examination (Fig. 293, 1) shows the marked overriding and angulation of oblique fracture, with incompletely ossified callus and a cavity containing a sequestrum in the lower fragment bordering on the overlapping upper end.

Operation (*May 1, 1919*).—Through a posterolateral incision the sequestrum and granulations were removed from the cavity and the callus excised from along its margins.

The after-treatment was with Dakin's solution, and in three weeks the wound was largely closed and covered with healthy granulations (Fig. 293, 2). It was decided to operate again with the idea of reducing the shortening and lateral displacement. May 22d, through a lateral incision, the fragments were freed of soft parts for a distance of 3 inches beyond either end, and cut to mortise into each other. By means of combined extension with the Hawley table and the Schroeder clamp the lower fragment was

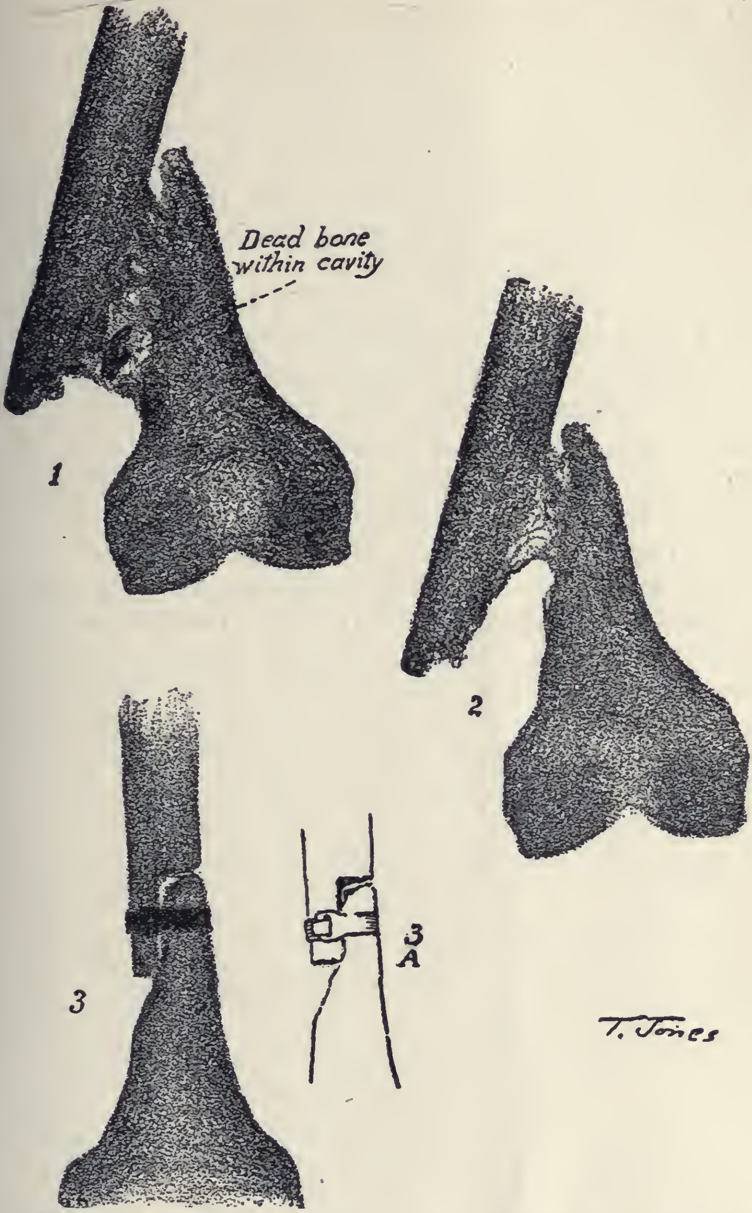


Fig. 293.—1, Cavity and dead bone with non-union eleven and a half months after injury. 2, Condition after removal of sequestrum and injection with Dakin's solution. 3 and *3 A*, Fractures reduced and held by Parham band.

brought down and fitted into the mortise of the upper, as shown in Fig. 293, 3 and 3 *A*. The fragments were fastened in position by a Parham band and a plaster-of-Paris body and leg cast applied. A window was cut out and the wound treated with Dakin's solution. There has been little reaction since the operation, and it is hoped that bony union will occur in the presence of the moderate infection which is present. As soon as sufficient callus has formed, which should require from three to four months, the Parham band will be removed. If dead bone should form as a result of the operation, it will subsequently be removed.

It would have been better to wait until weeks after the wound was entirely healed before reducing the deformity, but with the large cavity in the upper end and bordering on the lower end of the upper fragment, healing would not take place without removal of the overlapping upper fragment; in which case reduction would then have been impossible. The case illustrates how it may be necessary to take the chance of operating in the presence of infection reduced to a minimum in order to overcome extensive deformity.

CLINIC OF MAJOR EDWIN W. RYERSON

U. S. A. General Hospital No. 28, Fort Sheridan, Illinois
(Orthopedic Service)

CHRONIC DISLOCATION OF OUTER END OF CLAVICLE: RECONSTRUCTION OF ACROMIOCLAVICULAR ARTICULATION BY THE AID OF A STRIP OF FASCIA LATA

Summary: Inability to abduct arm from side without pain as a result of accidental injury sustained three years previously; diagnosis; operative findings; method of suturing transplanted fascial strip; result.

F. R. K., private, U. S. Army, while in service on the Mexican Border in July, 1916, was thrown from a bicycle, striking his left shoulder against the sidewalk. There followed considerable local pain and swelling, but no abrasion or flesh wound. The surgeon at Camp Wilson painted the shoulder with iodin and prescribed a liniment. The pain and disability gradually disappeared except when the patient attempted to abduct the arm from the side. He was only able to abduct to about 60 degrees. He was mustered out from border service January 20, 1917, but was recalled to service on April 4, 1917, and sent overseas on February 18, 1918. He continued to have pain on abduction of shoulder, and an x-ray examination was made at Limoges, France, Base Hospital No. 13, which did not disclose a fracture. He was given orderly duty in France because carrying a pack caused pain in the shoulder. He was gassed and sent to a hospital, where he recovered entirely from effects of gas, but was kept in hospital on account of trouble in the shoulder.

He was transferred to the United States, and sent to General Hospital No. 28, Fort Sheridan, Illinois, Orthopedic Service, a short time ago.

On admission to this hospital examination revealed an upward dislocation of the left clavicle at the acromioclavicular joint, the

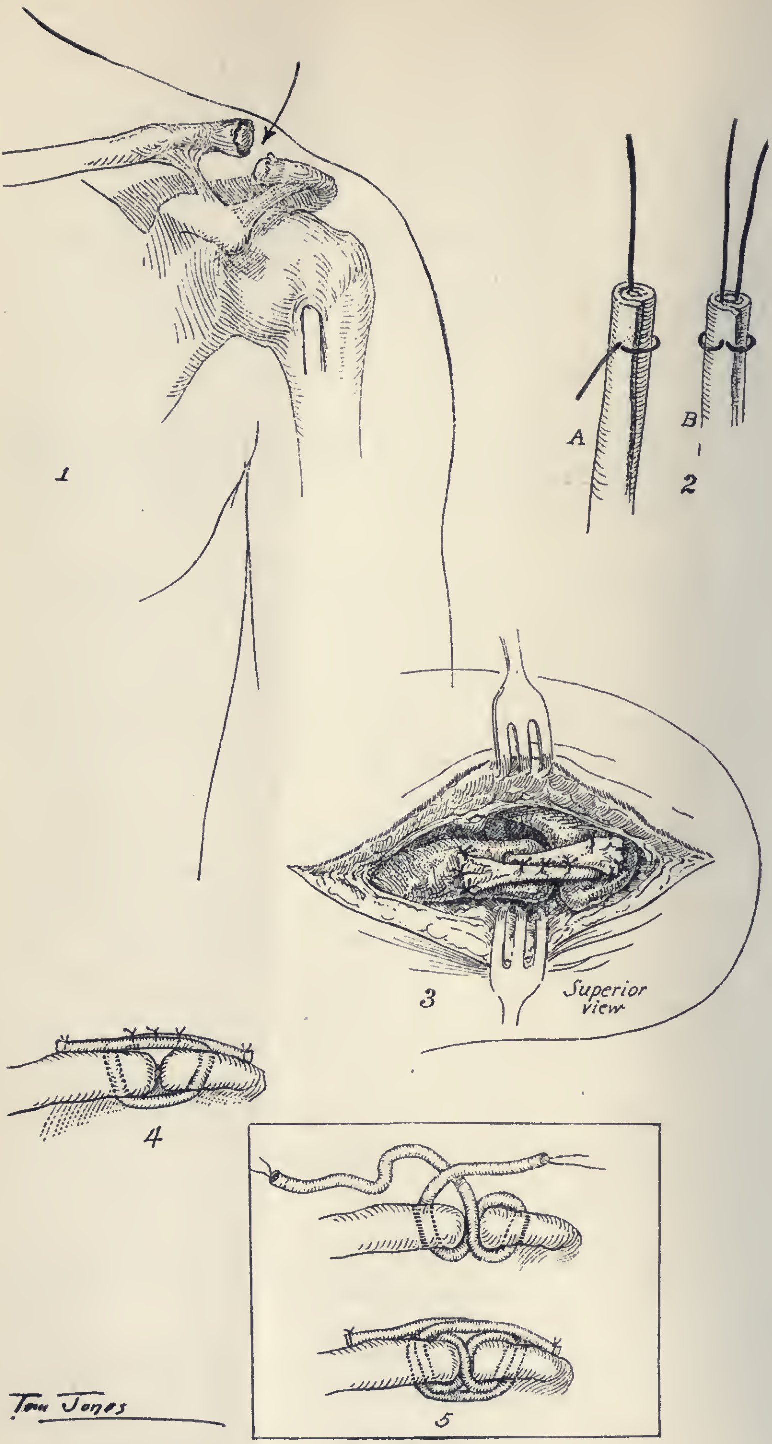


Fig. 294.

displacement being about $\frac{3}{8}$ inch. The clavicle could readily be replaced, but immediately returned to its abnormal position. There was no tenderness or pain except when abducted beyond 60 degrees. The deltoid was somewhat smaller than on the right side and the muscular power was much diminished. There was no grating or crepitus on motion.

The *x*-ray plates showed no bone disease and no fracture. The distance between the acromion and the clavicle was increased.

In view of the very considerable disability an operation was performed by the following method:

The acromion and the outer third of the clavicle were exposed. The acromioclavicular ligament was found to have been torn completely from its acromial attachment, and to have been partially repaired by cicatricial tissue. It was so long and lax that it exercised no restraint whatever upon the abnormal mobility of the joint. The coracoclavicular ligament was untorn, but was apparently of unusual length, so that it did not prevent the undue upward movement of the clavicle (Fig. 294, 1).

A hole was drilled with a $\frac{3}{16}$-inch drill downward and outward through the end of the clavicle, toward the bottom of the articulation. A similar hole was then drilled downward and inward through the acromion, converging toward the bottom of the clavicular hole. A strip of fascia lata 4 inches long and 1 inch wide was cut from the thigh, and was carefully denuded of fat. It was then rolled up to form a cord, and a strong suture was sewed into one end to be used in pulling the fascial cord through the holes in the bones. The suture is a combination of purse-string and mattress suture, and is very useful in this sort of work, as it prevents the ends from stripping back, and also gives a firm hold on the fascia or tendon (Fig. 294, 2).

Fig. 294.—1, Schematic representation of operative findings. Note complete tear of acromioclavicular ligament and apparent lengthening of coracoclavicular ligament, thus permitting upward dislocation of outer end of clavicle. 2, *A* and *B*, Method of inserting sutures in artificial ligament of fascia lata. 3, Fascial transplant sutured in position; operation will be completed by closure of skin incision. 4, Diagram of way in which roll of fascia was used. 5, Proposed improved method.

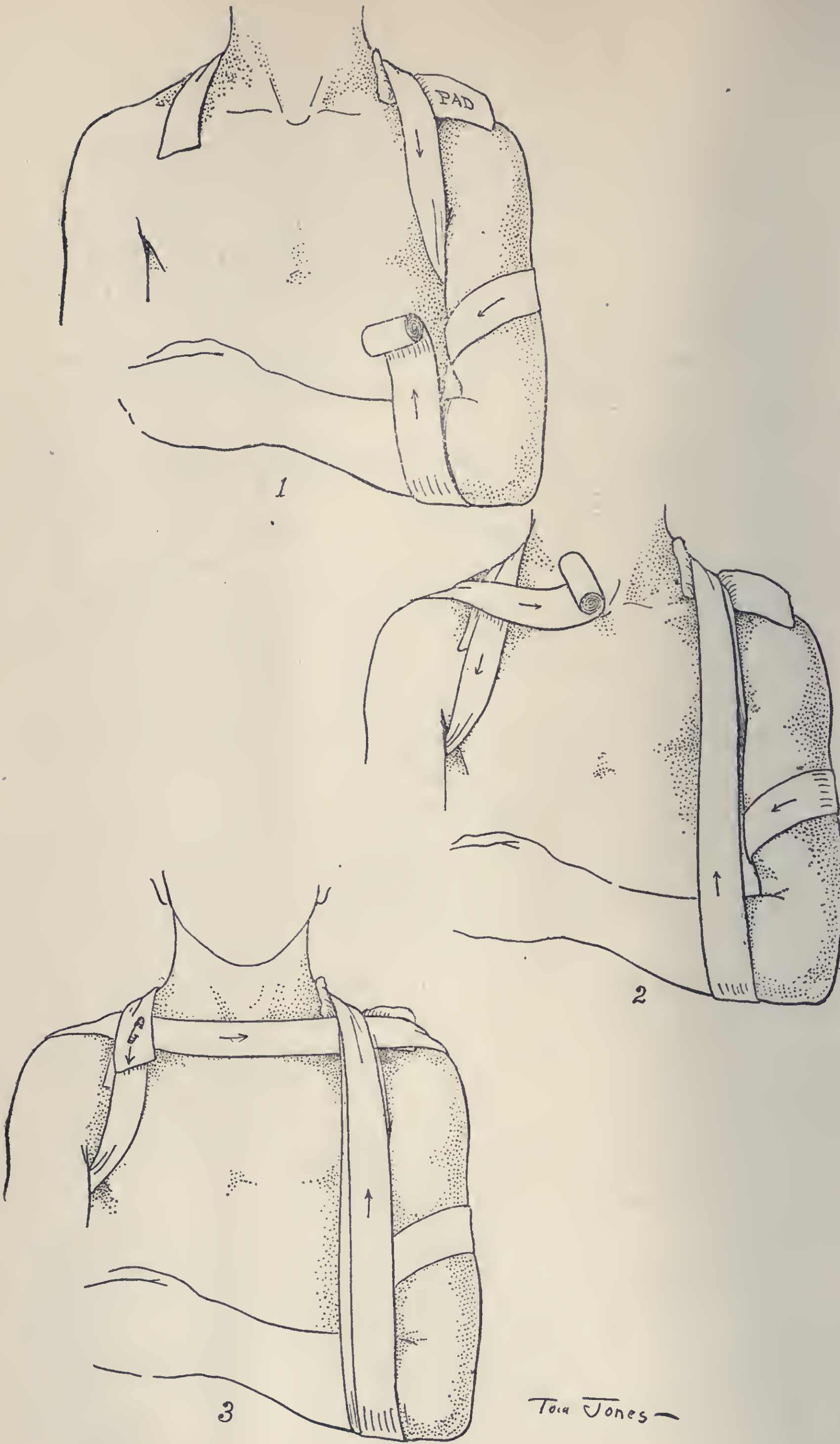


Fig. 295.

The fascial cord was now passed through the holes and pulled tightly enough to approximate the acromion and clavicle. The ends of the cord were lapped over each other, and sutured firmly together and to the periosteum of the bones with chromicized catgut (Fig. 294, 3, 4). The line of union seemed very strong, and there was no tendency to displacement when the arm was moved up and down.

The skin was sutured and the wound dressed. A figure-of-eight bandage was applied, going under the elbow and over the shoulder, crossing the clavicle, and down on the other side below the right axilla, so as to hold the arm up and the clavicle down. A felt pad was placed under the bandage where it crossed the clavicle and the wound (Fig. 295, 1, 2, 3).

Comment.—The patient made an uninterrupted recovery, and after eight weeks was able to abduct his arm to practically the full normal extent without pain. He is now apparently entirely well.

It was at first believed that it would be necessary to perform a similar procedure with the coracoclavicular ligament, as it seemed likely that this structure had been torn, or at least overstretched, since it presumably has more part in checking the upward movement of the clavicle than has the acromioclavicular ligament. The outcome of the case, however, shows that it was not necessary.

The technic of the operation could have been improved by passing the fascial cord in figure-of-eight fashion from the clavicle to the acromion, as it would form a sort of crucial ligament instead of a loop, and the upward motion of the clavicle would be better controlled (Fig. 294, 5).

Fig. 295.—1–3, Method of applying postoperative dressings. Their object is to support the arm and help to overcome tendency of clavicle to be displaced upward.

FLAIL ELBOW FOLLOWING EXCISION OF LOWER END OF HUMERUS. OPERATION TO PRODUCE STABILITY OF ELBOW-JOINT

Summary: Complete destruction of elbow-joint due to lodgment of fragment of high explosive shell and subsequent debridement resulting in flail elbow; condition eight months later; preparation for operation; use of antitetanic serum; technic of reconstruction of joint; result.

A. K., private, A. E. F. On August 4, 1918, in the Argonne Forest the patient was struck by a fragment of high explosive shell in the right elbow. A compound comminuted fracture of the lower third of the humerus and the upper end of the radius resulted, the missile entering above the external condyle, passing downward, and embedding itself just below the head of the radius. The wound was dressed at a first-aid station, and antitetanic serum administered about a half-hour after the injury was received. He was sent to the hospital at Chateau-Thierry the next day, and was operated upon at 9 P. M. the same night, August 5th. A debridement was performed, and the lower end of the humerus and the upper end of the radius were removed. A Thomas arm splint was applied, and two days later the patient was sent to Base Hospital No. 5 at Paris. The Carrel-Dakin treatment was instituted, and twenty days later a pocket of pus was evacuated at the upper end of the wound. The Dakin fluid was used until October 2d, when the wounds were dressed with dry gauze and a plaster splint applied. The wound was completely closed on December 18th. Evacuation to Ellis Island Hospital November 18th, and sent to Fort Sheridan on March 2, 1919.

On removal of the cast the elbow was found to be a typical flail joint, bending backward and sideways as readily as it bent forward. It could also be twisted around freely on the long axis. The patient had no control of the joint, and was unable to move the forearm upon the arm except by shaking it around in a dangling fashion. The wound was healed, and the scar was pale and painless. The muscles above and below the joint were atrophied,

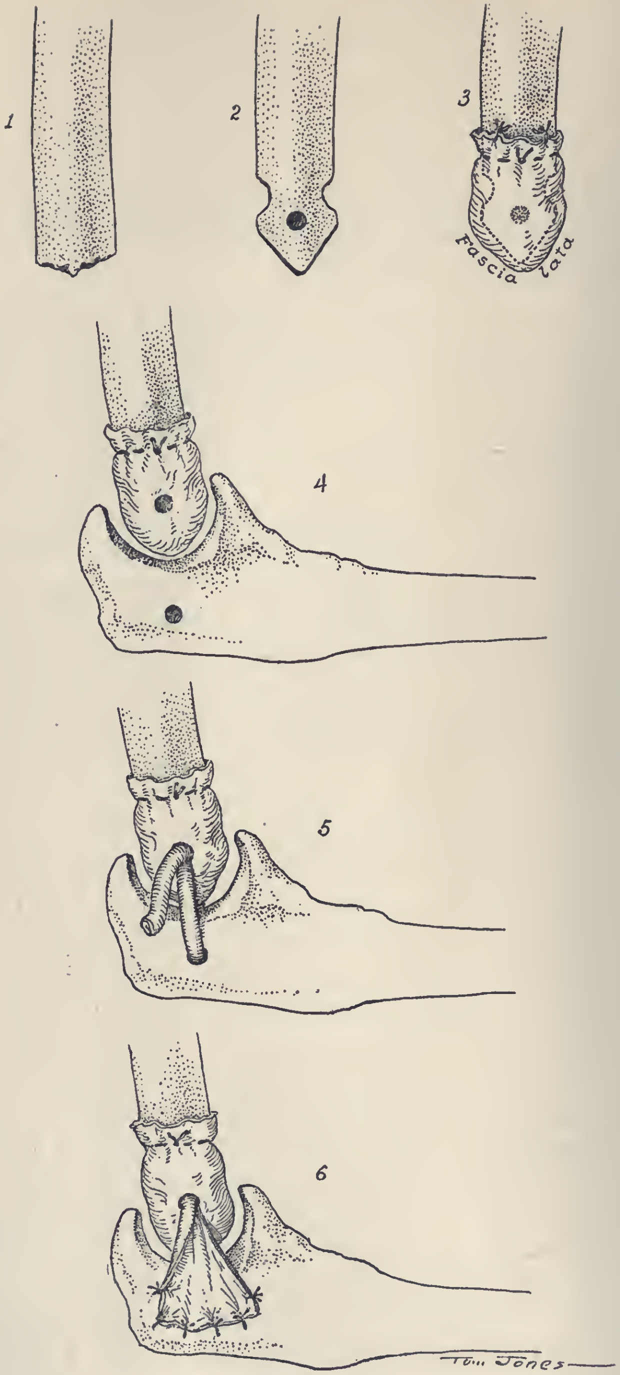


Fig. 296.

and the fingers and wrist were stiff from disuse. The lower end of the humerus was narrow and pointed, and the condyles were absent. The head of the radius could not be felt.

x-Ray examination confirmed the physical findings, and did not disclose any sequestra or foreign bodies. All of the bones showed marked atrophy of disuse.

For two weeks the arm was used as freely as possible, and was massaged in order to bring to light any latent infection which might be present. There was no reaction whatever to these vigorous measures, and it was considered safe to perform an operation to restore some measure of stability to the loose joint. Antite anic serum was administered, and on March 18th he was anesthetized after twenty-four hours' preparation of the field of operation.

The long scar on the lateral aspect of the arm and forearm was carefully dissected away, and the joint was exposed. The lower end of the humerus was brought into view, and was simply a narrow cylinder of bone with a pointed end. It had been shortened about 2½ inches by the removal of the condyles and the expanded lower part of the shaft. In accordance with a preconceived plan (original, so far as the writer knows), the lower end of this bone was sawed into a wedge shape with a small hand-saw, and a piece of fascia lata was securely sewed over the end and about 1½ inches upward on the shaft, covering all of the exposed bone. This latter procedure was perhaps unnecessary, but was deemed advisable in order to prevent a possible bony ankylosis (Fig. 296, 1, 2, 3).

The upper end of the ulna was now freed from adhesions and brought out of the incision. The greater sigmoid fossa was cleaned of the dense scar tissue which filled it, and was made larger and longer by filing it out with a round file. The end of the humerus was now placed in the sigmoid fossa and was found to fit it rather accurately from side to side, and to allow a very

Fig. 296.—1, 2, 3, Preparation of lower end of humerus. Note notches to take the olecranon and coronoid, and fascia lata cap over remodeled bone. 4, Sigmoid fossa scraped out and bones placed in position. 5, 6, New lateral ligaments made of fascia.

fair range of flexion and extension (Fig. 296, 4). In order to increase this range of motion notches were cut in the humerus, front and back, to allow the olecranon and the coronoid process to sink into them at the extremes of motion. A ¼-inch hole was now drilled transversely through the humerus, and a similar hole through the ulna midway between olecranon and coronoid, and a long piece of fascia lata, rolled up into a cord, was passed through these holes so as to approximate the two bones and to hold the humerus in place in the sigmoid fossa. The fascial cord was sewed firmly to itself and the ends were spread out like a fan and sewed to the ulna, to imitate the lateral ligaments (Fig. 296, 5, 6).

This made a firm and satisfactory joint, with a good range of motion, and very little tendency to lateral deviation, so far as could be judged at the time. The incision was sutured, and a plaster-of-Paris splint applied and split up both sides so as to make an anterior and a posterior molded splint. This was to have been supported by a sling to prevent strain upon the fascial ligament, but through an error the sling was not used until several days after the operation, so that the fascial cord actually carried the weight of the forearm and the cast for a considerable length of time.

It speaks well for the method that the result has been satisfactory. The wound healed rapidly, and in about six weeks active movements were begun. The joint is now stable, and the patient is rapidly gaining strength. He can move the elbow through an arc of about 65 degrees and the joint is painless. It is not yet possible to state an opinion as to the ultimate result, and a further report will be made at a later date.

NEUROMA OF MEDIAN NERVE IN PALM OF HAND DUE TO GUNSHOT WOUND

Summary: Healed gunshot wound of hand with evidence of involvement of flexor tendons and median nerve; large neuroma discovered at operation; excision of neuroma and end-to-end suture with hand in flexion.

Sergeant R. E. M., 128th Infantry, was struck at the base of the hand by a machine-gun bullet in the Argonne Forest on November 10, 1918. Four hours later a first-aid dressing was applied and he was given antitetanic serum. Bandages were changed at Field Hospital No. 128, and an operation was performed the next day at Evacuation Hospital No. 6, under ether. He then passed through several base hospitals, and was sent to Newport News. Dakin's solution was used for six weeks after the operation, and the wound healed on December 18, 1918.

He was admitted to U. S. General Hospital No. 28, Fort Sheridan, Illinois, on March 24, 1919.

Examination showed a scar 8 cm. in length running transversely over the thenar eminence in the palm of the hand. This marked the exit of the bullet. The wound of entrance was indicated by a small scar 2 cm. below the styloid process of the ulna on the posterior part of the wrist-joint.

Dorsal flexion of the wrist was slightly limited, and palmar flexion was normal. He was unable to close the fingers completely or to extend them actively to the full range of motion. Passive extension was normal. Tactile sensation was markedly diminished over the distribution of the median nerve, and slightly diminished over ulnar side of palm and last two fingers. The palm and first three fingers were glossy and sweating, and the nails showed trophic changes. The thenar eminence was atrophied.

On movement of the fingers the flexor tendons could be seen to pull on the scar, which limited motion considerably.

x-Ray examination showed fracture of unciform bone (os hamatum), with wide separation of fragments. The pisiform bone was absent.

Operation was performed on May 17, 1919, under ether anesthesia. The transverse scar was excised (Fig. 297, 1) and a careful dissection of the palmar structures was made, after cutting through the volar ligament. Directly under this ligament was a large bulb, easily identified as a neuroma of the median nerve, but of such great size that at first it was hardly recognized (Fig. 297, 2). About 2 mm. distal to the neuroma the nerve divided into three branches. With a small, keen knife the nerve-trunk was cut through at both extremities of the neuroma, and the two ends examined carefully. Normal nerve-bundles were seen projecting from the ends, and neither scar tissue nor edema was observed. The tendons of the flexor sublimis and flexor profundus digitorum were found to be adherent to each other and to the walls of the canal and to the scar by a mass of thin, delicate adhesions, which were easily separated. It was not deemed advisable to try to make sheaths for these tendons, since such work is not likely to be successful in this particular locality. It was decided to trust to passive and active motions of the fingers to preserve the mobility of the tendons.

The two ends of the nerve were now pulled upon gently to determine how nearly they would come together. It was found that they could easily be approximated when the wrist was held in about 60 degrees of flexion. A fine 00 chromicized catgut suture was now passed directly through the nerve, about 3 cm. from the end, with a very small needle. It was then carried down and passed upward through the distal end of the nerve, care being taken to see that the two nerve ends were in proper relation to each other in regard to rotation. With the hand held in flexion, the suture was tightened until the nerve ends were accurately approximated, without tension. Four plain catgut sutures were now placed at intervals in the nerve sheath, so as to close the gaps between the ends. This resulted in very satisfactory approximation (Fig. 297, 3). The nerve was laid back into its bed without any attempt to make an artificial covering for it. The strong volar ligament was then united with interrupted catgut sutures, and the wound was closed with waxed silk.

The incision has healed without infection, and the fingers

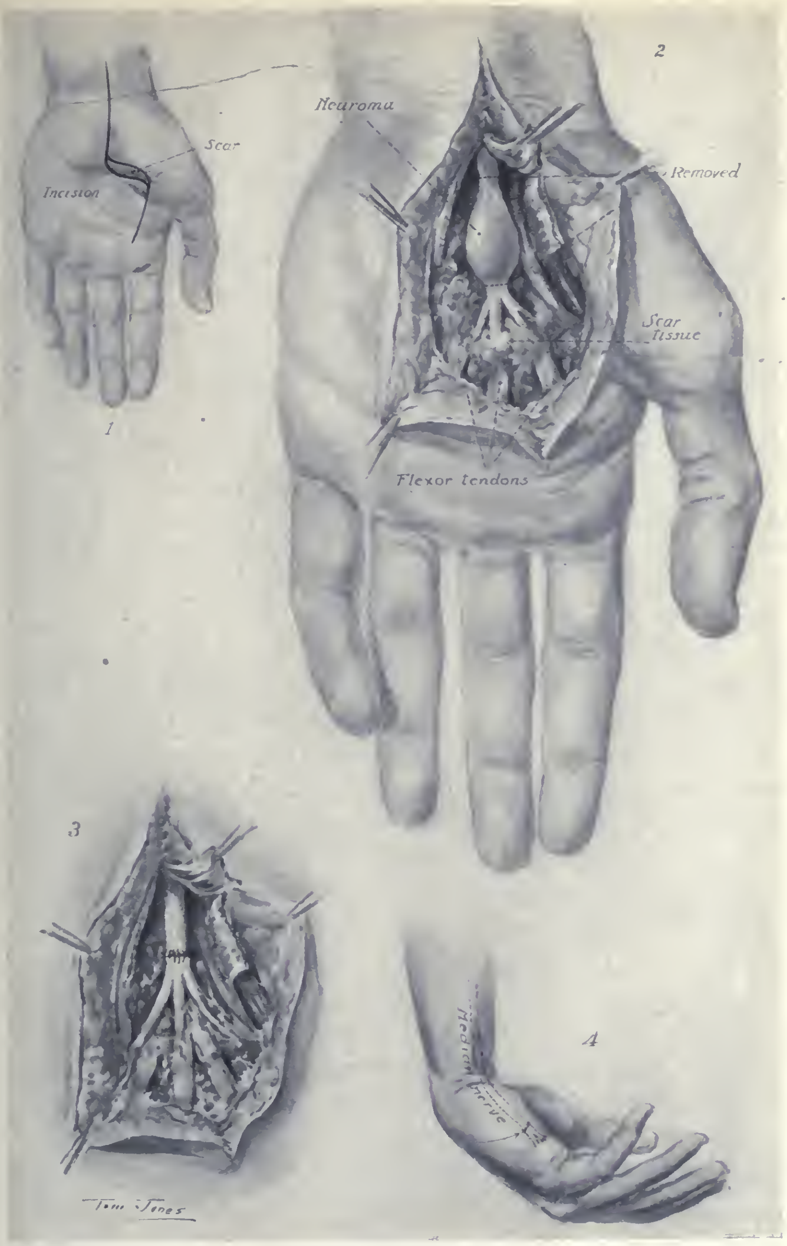


Fig. 297.—1, Incision for removal of scar and exposure of tendons. 2, Large neuroma on median nerve an unexpected finding; note lines of incision for its removal. 3, Nerve sutured after excision of neuroma. 4, Reversed cock-up position of hand to prevent tension on suture line.

are freely movable through the range permitted by the amount of flexion of the wrist, which is still held in a reverse cock-up splint. The splint will be retained for a four-week period, and the wrist will then be gradually straightened (Fig. 297, 4).

The case is of interest simply from the unusual size of the neuroma, and from the fact that the tendon involvement seemed at first to be the major lesion.

CLINIC OF MAJOR LEWIS J. POLLOCK

General Hospital No. 28, Fort Sheridan, Illinois

PERIPHERAL NERVE INJURIES WITH ESPECIAL REFERENCE TO LESIONS OF THE BRACHIAL PLEXUS

Summary: Frequency of peripheral nerve injury in modern warfare; brachial plexus injuries; types in civil and military life; demonstration and diagnosis of typical cases; coincidence of spinal cord and brachial plexus injury; prognosis; necessity of careful observations in order to avoid overrating speed of recovery; antagonistic muscles in certain instances may become protagonistic; apparent sensory recovery may be produced vicariously through anastomatic branches of neighboring nerves.

Peripheral nerve lesions have contributed the largest amount of neurologic material that has been dealt with in this war. Statistics relative to the occurrence of peripheral nerve lesions sustained in battle are not as yet available. Those obtained from the reports of the A. E. F. are not reliable, for reasons which will be mentioned shortly. The ordinary procedure by which the neurologist was afforded the opportunity to study these lesions was to have them referred to him by some other service. That this method left much to be desired is now evident. From the reports of the various consultants of base hospitals the figures in the chief consultant's office at one time gave the percentage of peripheral nerve lesions as 1.76 of total casualties.

Inasmuch as this did not approach the figures given by the French and British, namely, between 5 and 6 per cent., a bed to bed canvass of most of the base hospitals in France was made at the instance of the Chief Consultant, and the figures derived from this search revealed an entirely different situation. In four base hospitals under my observation, of a total of 2151 cases examined, who had wounds of the extremities, 322 cases of peripheral nerve lesions were found, giving a percentage of 14.9 of cases examined, and of 4.5 of total population, which was 7049. It is evident that the percentage of cases of injuries to the peripheral nerves reported from the hospitals in the American Expeditionary Forces is dependent upon a number of factors, and upon the same factors governing the observation of the number of cases occurring is the analysis of the types of cases observed. For example, ulnar lesions were frequently reported, whereas median, especially incomplete medians, were often overlooked. Pre-eminently, lesions of the internal popliteal nerve were overlooked.

It is probable that if a careful survey were made peripheral nerve lesions would be found in 16 per cent. of all wounds of the extremities and in over 5 per cent. of total admissions.

Brachial plexus lesions have been said to constitute a greater percentage of incidents than all others by some English writers, among whom may be mentioned Purves Stewart, who found 61 cases in a material consisting of 318 cases of peripheral nerve lesions. From a material consisting of 500 cases of peripheral nerve lesions observed soon after injury in base hospitals in France there was a total of 44 cases of brachial plexus lesions which were referred to me for examination.

That the number of cases of brachial plexus lesions reported by many observers does not bear a true relation to the total number of peripheral nerve cases is as evident as the fact that the correct percentage of peripheral nerve lesions is as yet unavailable. From the material at Fort Sheridan, consisting of 250 cases, but 15 cases of brachial plexus lesions may be gathered. This, it may be said, is a small percentage.

The cases which I have for demonstration today have been selected for the purpose of demonstrating some of the types of brachial plexus lesions.

Brachial plexus lesions in civil practice have been divided, as to type, into lesions of the primary cords, secondary cords, and root lesions. The secondary cords usually spoken of as the cords of the brachial plexus had been the most frequent type of lesions observed. The cases have likewise been divided into upper arm paralysis, as the Erb-Duchenne type of injury of the fifth and sixth cervical nerve, and of the lower arm paralysis, or the Klumpke type.

Direct lesions of the brachial plexus due to war wounds present no clearly defined classification. Ordinarily, immediately following injuries there is complete paralysis of the brachial plexus, which, as the effects of the concussions disappear, resolves itself into one or another type of involvement of one or more cords, or an incomplete type of total brachial plexus paralysis.

Lesions of the inner cord of the brachial plexus are evidenced by paralysis of all the intrinsic muscles of the hand and some or all of the flexors of the wrist and fingers. Lesions of the posterior cord are evidenced by paralysis of the muscles supplied by the circumflex, musculospiral, and subscapular nerves. Lesions of the outer cord result in paralysis of the muscles supplied by the musculocutaneous and median nerve with the exception of the intrinsic muscles of the hand.

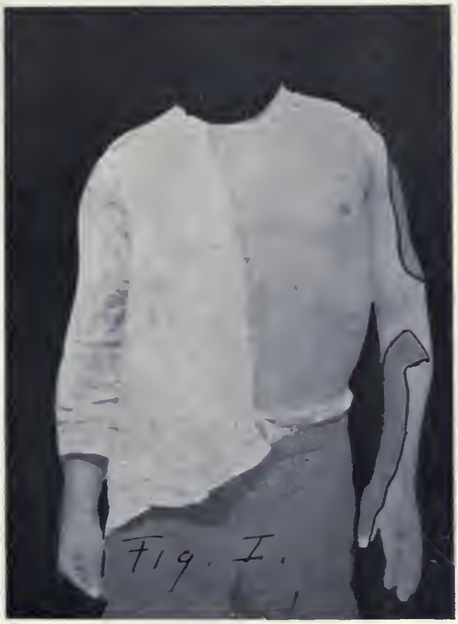


Fig. 298.—Shaded areas indicate areas of sensory changes following lesion involving nerves from the fifth, sixth, and seventh cervical segments.

Case I.—G. B., wounded July 15, 1918, by shrapnel, with entrance just to the left of the midline of neck over the clavicle, and exit over the spine of the scapula. He sustained a fracture of the left acromion process of the scapula. Upon examination he shows paralysis of the deltoid, biceps, very marked weakness in the supinators, and in the muscles supplied by the subscapular nerves. There is analgesia, anesthesia, and loss of temperature sense over the fifth, sixth, and seventh cervical segments.

This case would be classified as an upper muscle type, or an Erb's palsy. It could likewise be termed a combined partial posterior and outer cord lesion of the brachial plexus. The probability is that in this case the soldier sustained a lesion of the primary cord of the brachial plexus (Fig. 298).

Case II.—C. S., wounded October 5, 1918. Machine-gun bullet entered shoulder just above scapula and lodged in neck above clavicle. The entire right arm completely paralyzed immediately following injury. In one month began to move fingers and at the same time sensation began to return. He then showed complete paralysis of the infraspinatus, supraspinatus, deltoid, biceps, trapezius, triceps partially paralyzed, supinator very weak, extension and flexion of wrist moderately weak, grip fair. At the present time he has motion in every muscle of the upper extremity and only weakness where paralysis formerly existed.

In this case we are dealing with a lesion of the posterior cord combined with the outer cord. Regeneration has occurred to such a degree that sensory disturbances are present only over the radial distribution.

Case III.—L. P., wounded October 18, 1918, Verdun, gunshot wound of right shoulder, entrance in a line below the clavicle and inside the shoulder-joint, exit 2 inches to the right of the spine over the eighth dorsal vertebra. Arm hangs helplessly by the side, the hand is cold and moist. There is marked atrophy of the upper arm and deltoid, the muscles of the forearm, and palmar interossei. There are sensory disturbances over the distribution of the musculocutaneous, internal cutaneous, median and radial. At the present time it is noted that the deltoid is slightly weak, triceps weak, biceps very weak; supinators pull 1 pound, pronators 3, extensor carpi radialis 5, ulnaris paralyzed, flexor carpi ulnaris pulls 12; radialis paralyzed; common extensors paralyzed; weakness of the two inner slips of the flexor sublimis digitorum. Sensory disturbances at the present time only over the radial and musculospiral.

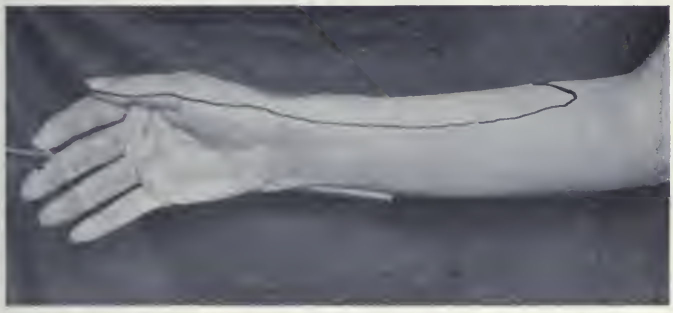


Fig. 299.—Area of sensory disturbance remaining six months after lesion of posterior and outer cords.

We have here a regenerating lesion of the posterior and outer cords (Fig. 299).

Case IV.—K. B., wounded October 13, 1918, gunshot wound of left axilla. Sustained immediate paralysis of his forearm. On February 22, 1919, showed marked atrophy of the thenar and hypothenar eminences of all the muscles of the arm and forearm. Fingers and thumb show no movement except slight flexion of the thumb at the distal joint and of the fifth finger at the metacarpophalangeal joint. Flexion and extension of the wrist abolished, supination weak, pronation abolished. Sensory disturbances present over the ulnar, median and radial. At the present time the extensors of the wrist pull 5 pounds, flexors 3, pronators 5, supinators none, triceps 11, common extensor, 20 grams; extensors of the thumb 50 grams, flexor profundus digitorum 3 pounds, interossei none, opponens none, adductor pollicis 2. Sensory disturbances over the distribution of the ulnar, the median and radial, most marked in the radial.

We are dealing here with a lesion of the posterior cord combined with a lower (Fig. 300).

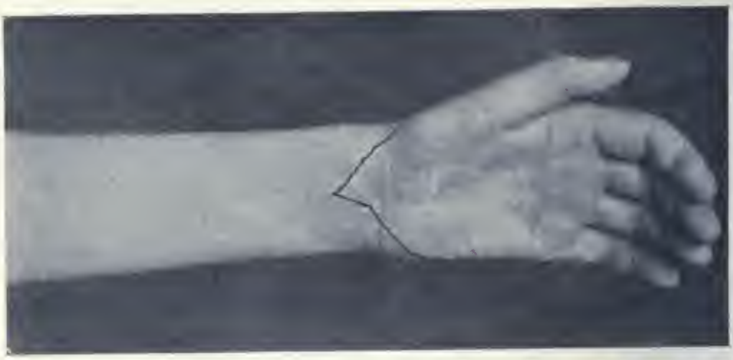


Fig. 300.—Note atrophy of thenar and hypothenar eminences.

Case V.—H. M., wounded October 14, 1918, gunshot wound. Bullet entered 2 inches above and to the outside of the angle of the scapula and had its exit just above the middle of the clavicle. On Feburary 15, 1919, examination showed the arm to hang helplessly by the side with wrist-drop, marked vasomotor change, and edema of the hand. There was atrophy of the supra- and infraspinati, the serratus magnus, the pectorals, the deltoid, upper and lower arm, thenar and hypothenar eminences, and palmar interossei. There was marked weakness in the deltoid, teres minor, and flexors of the wrist. The extensors of the wrist were paralyzed. All function was lost in the fingers except slight flexion of the distal joint of the fifth finger and slight adduction of the thumb. Sensory disturbances were present over the distribution of the internal cutaneous, ulnar, musculospiral, and circumflex nerves. On April 1, 1919, there was reaction of degeneration in the deltoid, supinators, and the other muscles supplied by the musculospiral, the median, with the exception of flexor carpi radialis and the ulnar. It is notable that the biceps was preserved. At the present time the paralysis involves the same distribution, but to a lesser degree. The sensory changes show an involvement of the fifth, sixth, eighth, and first dorsal roots; the distribution over the sixth is but little involved. That over the area supplied by the internal cutaneous and ulnar show the greatest involvement.

We are here dealing with a combination of a lower cord with a posterior cord lesion (Fig. 301).

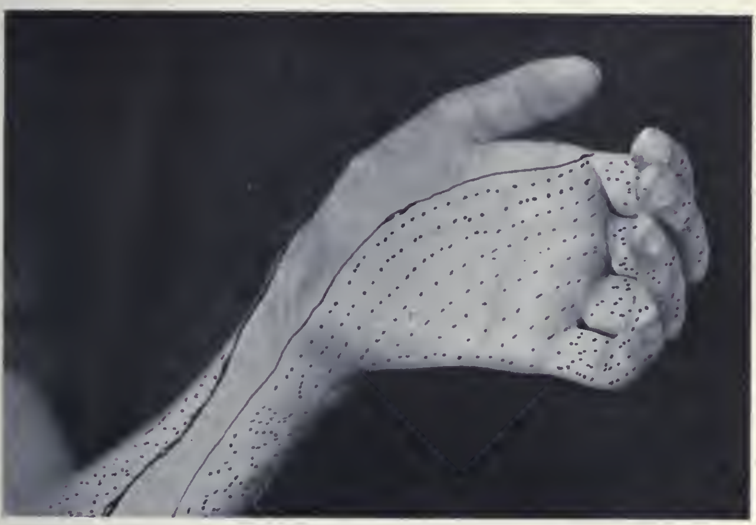


Fig. 301.—Combination of lower end posterior cord lesion. Note atrophy of intrinsic muscles of the hand, extension of first phalanges of fingers, and flexion of two distal phalanges; the metacarpal of the thumb is drawn outward and backward. Shaded area represents region of sensory changes.

Case VI.—H. R., wounded August 31, 1918, machine-gun bullet entered below the right coracoid process and had its exit below the angle of the scapula. At the primary operation the ulnar nerve was sutured. Examination January 18, 1919, showed slight atrophy of the muscles of the right shoulder girdle, moderate atrophy of the muscles of the arm and forearm, marked atrophy of interossei and lumbricales, and of the hypothenar eminence. This is paralysis of the interossei, flexors of the fingers, the opponens, and the muscles of the hypothenar eminence. The pronators are weak, palmaris longus is weak, the flexors of the wrist are weak, the supinators moderately weak. Sensory disturbances over the distribution of the ulnar and median, with the sensory syndrome of compression.

We are here dealing with an inner brachial plexus lesion which is severe but incomplete.

The concomitant involvement of the ulnar and median nerves gives rise in this case to the so-called ape-hand, which is characterized by the position of the hand, which is seen to be in the same plane as the remaining four fingers, widening the appearance of the hand. We see likewise the characteristic clawing, which is here observed in the four fingers.

Case VII.—F. B., wounded October 23, 1918, machine-gun bullet; entrance ½ inch above the clavicle and 1½ inches from the right sternoclavicular junction, exit ½ inch below the seventh spinous process in the midline. The right arm was immediately and completely paralyzed. On December 31, 1918, the triceps was slightly weak, pronators weak, extension of the wrist and fingers very weak, in all the flexors of the wrist and fingers but the slightest motion.

At the present time the extensor communis digitorum is very weak, the flexors are practically paralyzed, the opponens is paralyzed; the hypothenar eminence can pull 200 grams; the flexors of the wrist are slightly weak.

In this case we are dealing with a lesion of the brachial plexus which is probably localized in the primary cord of the eighth cervical and first dorsal. The sensory disturbance here is distinctly distributed over the area of the eighth cervical and first dorsal segments (Fig. 302).

Briefly viewing the cases here shown a few interesting points may be alluded to. The cases showing involvement of the musculospiral or radial nerve show three distinct primary symptoms pathognomonic of this condition: 1. Wrist-drop. 2. Inability to extend the first phalanges of the fingers. 3. Inability to extend the thumb. The cases showing ulnar palsy are characterized by three primary clinical symptoms: 1. Weakness or paralysis of the adductor pollicis, which is demonstrated by their inability to grasp firmly between the thumb and forefinger of the affected hand a flat object, without putting into use the flexor of the thumb. 2. The clawing produced by the over-action of the extensors of the fingers. 3. Inability to flex the little finger with the terminal phalanges extended. The cases marked by paralysis of the median nerve are characterized by three clinical facts: 1. Inability to oppose the thumb to the little finger. 2. Inability to flex the terminal phalanx of the thumb. 3. Inability to flex the index-finger. Cases showing combined lesions of the ulnar and median nerves produce the typical ape-hand.

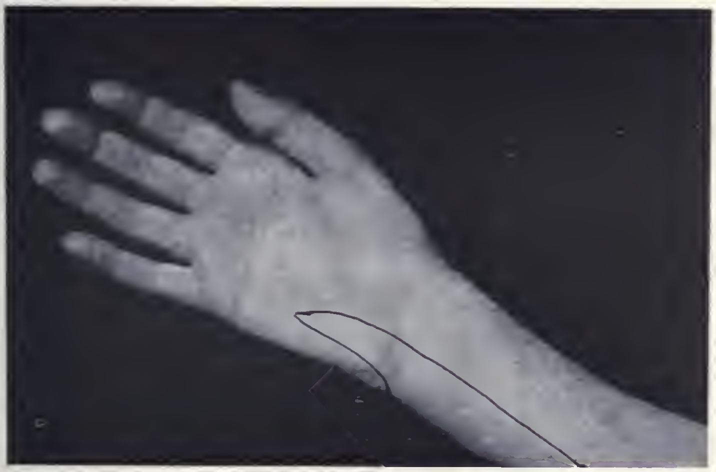


Fig. 302.—Lesion of primary cords of eighth cervical and first dorsal roots. Nearly complete paralysis of hand; sensory disturbances on ulnar side of forearm.

The striking feature of the clinical picture of early peripheral nerve lesions has been a large percentage of marked improvement and recovery in the cases which have been observed soon after injury. An analysis of the first 100 cases of which I have records, which were admitted to Base Hospital No. 13 in France, shows that four months after the beginning of the operation of the hospital there remained but 39 cases; 20 of these were manifestly partial lesions; 5 were so severe that operation was indicated and performed. The remaining number did not show a sufficient degree of involvement or some slight improvement which at that time contraindicated operation. Of the 61 cases discharged from the hospital, 20 had already sufficiently recovered to be sent to convalescent and replacement camps.

One of the interesting things observed in lesions of the brachial plexus has been the coincidence of lesions of the spinal cord with these injuries. These spinal cord lesions have been of two types; one, fortunately the more frequent, occurring immediately with the brachial plexus injury, in which the soldier falls with paralysis of his four extremities which rapidly develops into hemiplegia of the spinal type, and, therefore, a Brown-Séquard paralysis. When examined at this time there is found, in addition to the brachial plexus palsy on the side of the injury, paralysis of the leg on the same side, with slight loss of touch on that side, loss of tendon and vibration sense, and on the opposite side loss of pain and temperature sense. At times paralysis of the opposite arm of a root type may persist for a certain period. In a relatively short time the paralysis of the legs disappears, leaving only a brachial plexus palsy. The following case will illustrate:

I. F., wounded September 12, 1918. Shrapnel entered the back of the neck, traversing it from left to right. He had immediate paralysis of all four extremities. Upon examination September 19, 1918, he showed paralysis of the left arm and forearm of an upper brachial plexus type, and paresis of the left leg. There was weakness in the right arm. There was involvement of the left cervical sympathetic, analgesia, anesthesia, and loss of temperature sense in the left arm over the area supplied by the fifth, sixth, seventh, and eighth cervical segments, and in the right arm analgesia and loss of temperature sense only, in the seventh and eighth cervical and first dorsal segments. On the right side he showed analgesia and loss of temperature sense over the rest of the body below this area. On the left side he had hyperesthesia below the second dorsal segment. This case within a period of two months recovered all function with the exception of the brachial plexus lesion of the left side.

The next case shows a combination of Brown-Séquard paralysis which has recovered, with functional spasticity of the arm, which now resembles superficially a brachial plexus lesion.

J. H., wounded August 7, 1918, by high explosive, and was unconscious for six hours. Had ligation of the left jugular vein. Upon regaining consciousness found a left-sided hemiplegia. Forty days after injury a piece of shell casing was removed from the region of the fifth and sixth cervical vertebræ. The wound of entrance was in the left anterior triangle of the neck. At this time all movements of the left arm are possible, but weak. The deep reflexes of the arm when patient is relaxed are about the same as the right. There is slight ataxia of the left arm and leg. Marked hysteric spasm of the left hand. On the right side of the body below the level of the first dorsal there is diminution of temperature sense. The deep reflexes of the left leg are slightly greater than the right.

We are dealing here with a recovered Brown-Séquard paralysis showing functional spasm of the hand which might be confused with a brachial plexus lesion.

It might be said of Brown-Séquard paralyses in general that the cases which have been observed in the war have borne out the truth of the observations of Gordon Holmes relative to the crossing of the sensory tracts. Of the greatest clinical importance is the fact that brachial plexus lesions as a whole tend to recover spontaneously, and that lesions of the spinal cord in the cervical enlargement, whether or not associated with brachial plexus lesions, have a high percentage of spontaneous recoveries which contraindicate early operative interference.

There remains but one thing to which I call your attention, and that is the necessity of careful observation before and after operations. This is necessary so that the reports of incredibly rapid recoveries of the functions of peripheral nerves following nerve sutures be properly avoided. Such reports have never withstood the test of careful analysis and are due only to improper study. This care must be exercised both in the examination of the motor and of the sensory function. In the motor sphere it must be remembered that many supposedly antagonistic muscles have, under certain conditions, protagonistic functions. Examples of this mechanism are manifold, some of which I may mention. Extension at the wrist may be simulated by passive movement of extension through strong flexion of the fingers and adduction of the thumb. The proximal phalanges may be tensed by the action of the interossei. The terminal phalanx of the thumb can be extended by the flexor brevis pollicis and the abductor brevis pollicis. These movements, of course, would confuse one in a case of musculospiral palsy. In ulnar palsy a substituted movement for adduction of the thumb is produced by the action of the opponens pollicis and the flexor brevis pollicis, as well as by the extensor longus pollicis when the wrist is strongly extended. In combined lesions of the ulnar and median, flexion at the wrist can be produced by the abductor longus pollicis.

The sensory functions, owing to the profusion of anastomoses, must receive careful analysis. Immediately after injury the complete physiologic area of a nerve may be completely anesthetic, but after a time but a small portion of this area shows complete sensory loss. Only some of this return of function is due to regeneration. A great deal is dependent upon the vicarious functioning of the anastomotic nerves. That this is true is shown by the fact that if in a lesion of a peripheral nerve, where there had been observed complete sensory loss in the ordinary physiologic distribution of the nerve, this area shows shrinkage, a subsequent section of the nerve does not again produce complete sensory loss in the original area. It can readily be seen that unless a careful examination be made prior to operation, the relatively small amount of sensory disturbances may be interpreted as a sign of nerve regeneration. Notable among such cases are the injuries of the musculospiral nerve.

CLINIC OF CAPTAINS FRANK A. NORRIS AND RUDOLPH S. REICH

General Hospital No. 28, Fort Sheridan, Illinois

THE FATE OF FOREIGN BODIES IN TISSUES

Summary: Frequency of foreign bodies in the tissues of wounded soldiers; foreign bodies usually innocuous; exceptional cases; indications for removal; demonstration of typical cases.

Foreign bodies play a very small part in the late surgery of war wounds. From December 1, 1918, to April 1, 1919, we have collected 184 cases which comprise about 10 per cent. of all patients in this hospital with wounds. The foreign bodies vary in size from minute particles to pieces 5 to 10 cm. in length, and have been in the tissues for a period of six to ten months, and only seventeen primary operations have been necessary for their removal. Some have been removed at the time of operating for osteomyelitis or other conditions, but as secondary affairs. The majority cause no disability whatever and have not interfered with results in bone transplants, nerve sutures, and other surgery. In our experience here they play practically no part in the pathology of osteomyelitis unless they are in the infected field, or communicate by a sinus. In the great majority of instances they are encapsulated in the tissues and are innocent, sequestra being the whole disturbing factor in about 90 per cent. of the cases.

Of the above total, 5 cases have foreign bodies in the brain substance, of which 3 have been removed. Two were removed preliminary to bone transplants to fill defects in the skull, the first from the frontal region, the second from the temporal region just anterior to the petrous portion of the temporal bone, and neither of these cases had symptoms as the result of their foreign bodies. The third case had a fragment of shell in the left parietal lobe posteriorly, which had driven in with it six small pieces of bone. An infected sinus was formed communicating with bone and shell. Immediately following injury hemiplegia resulted, and later epileptic seizures developed. Two previous attempts had been made at removal. The two remaining cases had been associated with hemiplegias and will be removed at some future date.

In the thorax 15 cases have been found, only one of which has been removed, and that from the pleural cavity because of constant mechanical irritation. Two have bullets in the pleural cavity and are associated with hemothorax, which required aspiration. There was no indication for removal, as both patients improved without infection developing. Five were localized in the lung substance, one with active empyema, but there was no communication with foreign bodies. In the remaining 7 cases the missiles were situated in the thoracic wall where they caused no annoyance.

Two cases had foreign bodies in the posterior muscles of the neck, in which the wounds healed without infection or any later trouble. Of 4 cases of foreign bodies in the lumbar region, 2 healed without difficulty, the third was complicated by osteomyelitis of the ilium, and in the fourth it was necessary to remove four pieces of shell from the subcutaneous tissue because of mechanical irritation.

Out of 10 cases of foreign bodies in the pelvis one was removed from a sinus leading from the urethra. In the second case a machine-gun bullet was removed from the wing of the ilium with necrosis and sequestrum formation which had to be re-operated, and the third had osteomyelitis of the ischium with loss of sphincter control. In this case healing has not yet occurred. The 7 remaining are healed.

In the upper extremity 65 cases have been removed, 17 about the shoulder, 24 in the arm, 12 in the forearm, and 12 in the hand. In the lower extremity 81 cases were found, which included 34 in the thigh, 29 in the leg, and 18 in the foot. In the extremities 14 cases had osteomyelitis and all have been operated and are doing well with foreign bodies still in their tissues. Two

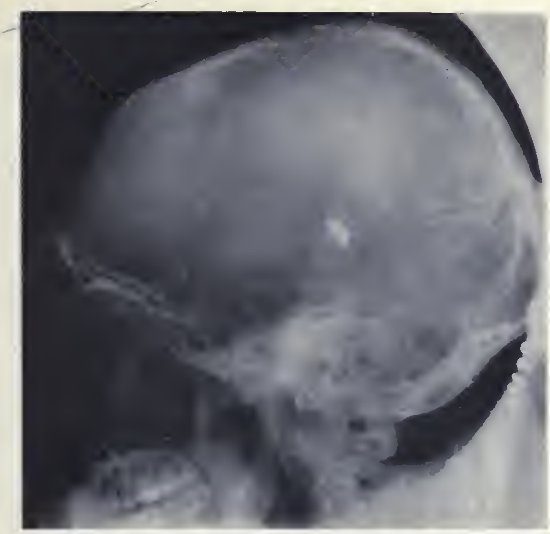


Fig. 303.—Foreign body in parietal lobe posteriorly, with bone defect in frontal region.

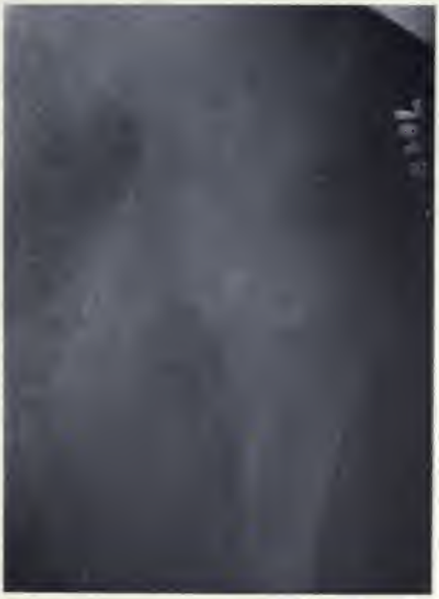


Fig. 304.—Foreign body in neck of femur, with encysted abscess.

cases had as many as forty fragments of shell in the tissues of the thigh, which were encapsulated. Two cases were operated with foreign bodies in the buttocks on account of pain from pressure. In one instance a piece of high explosive shell extended from the lateral condyle of the femur into the knee-joint, and was removed.

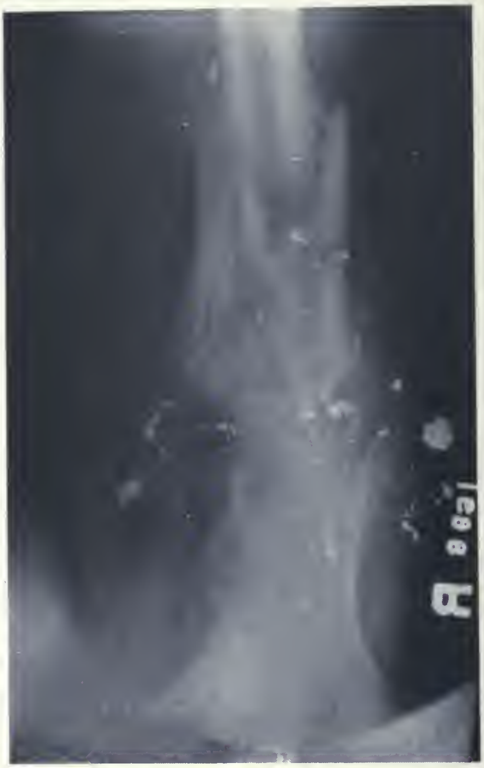


Fig. 305.—Foreign bodies about osteomyelitis not interfering with healing.

There are two men who have foreign bodies encapsulated in the soft tissues of the lower jaw which have produced no symptoms. One case in which a foreign body had penetrated the great trochanter caused ankylosis of the hip-joint. The wound had been healed for five months. An arthroplasty was indicated, and when the great trochanter was sawed through a pus pocket was found about a piece of shell. The shell was removed and, of

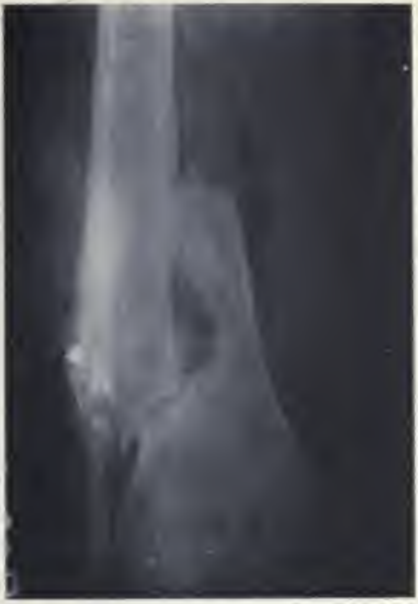


Fig. 306.—Foreign body encapsulated about osteomyelitis.

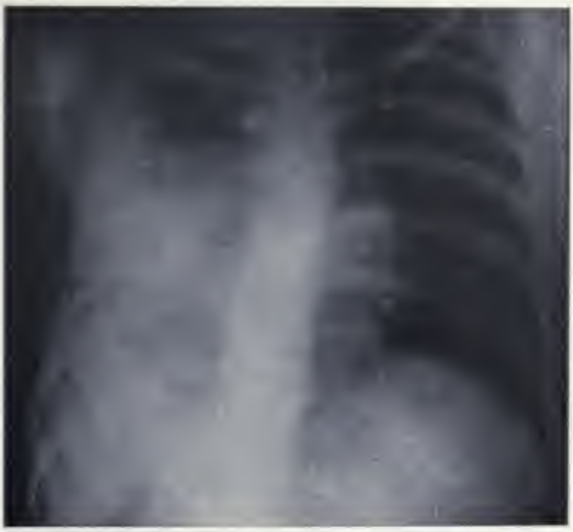


Fig. 307.—Foreign body in lung substance with empyema—no communication with piece of shell.

course, operation deferred. This is the only case of latent infection about a foreign body.

In conclusion, it may be said that the indications for the removal of foreign bodies are,—when they produce mechanical irritation, pressure, or when they are located in the infected field. From the above cases, which have been carrying foreign bodies for a period of from six to twelve months, it would seem that metallic foreign bodies cause very little trouble in the tissues. They are not porous, therefore do not harbor organisms, and usually become sterile and encapsulated, while sequestra are porous, harbor organisms, and consequently must be removed. When foreign bodies cause mechanical irritation in the pleura or are adjacent to nerves, as, for instance, in the sciatic, resulting in causalgia, or when they are in close approximation to a blood-

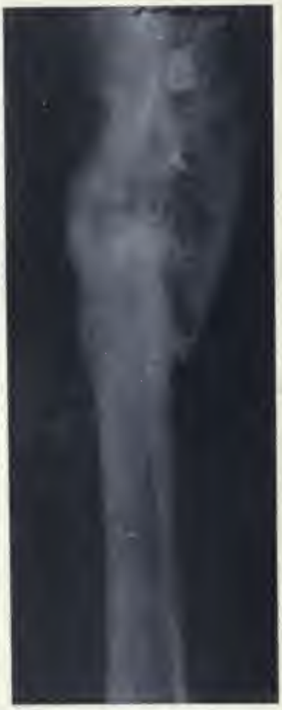


Fig. 308.—Foreign body about osteomyelitis not interfering with healing.

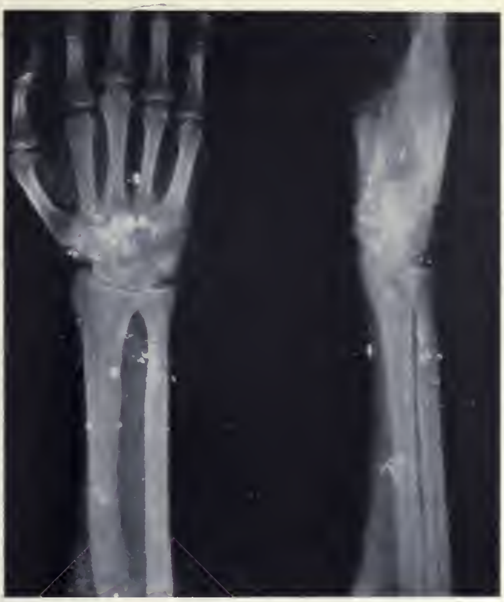


Fig. 309.—Foreign bodies in hand and forearm, without symptoms.

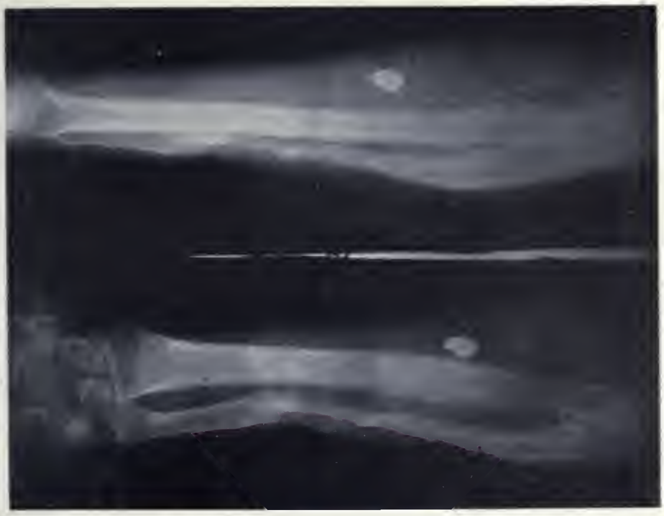


Fig. 310.—Bone transplant of ulna with two pieces of shell in tissue.

vessel causing erosion of its wall, it is obvious that removal is necessary. When a piece of shell is free in a joint or projects into it, serious damage results and it must be removed. Removal is also indicated when foreign bodies are located about points of pressure, most commonly the sole of the foot, the palm of the hand, the back, and buttocks. In the brain, removal seems advisable, as the foreign bodies are associated with hemiplegia, epilepsy, and mental defects, and there is danger of late irritation from cyst formation and consequent pressure.

In conclusion we present the following *x*-ray plates as examples of typical cases of foreign bodies in the tissues. In the light of the preceding discussion these plates are practically self-explanatory (Figs. 303–310).

CLINIC OF DRS. ARTHUR DEAN BEVAN AND THOR C. ROTHSTEIN

Presbyterian Hospital

BRAIN TUMOR

Summary: A patient giving a history of headaches and epileptiform attacks extending over a period of years; weakness of the left arm and leg discovered on examination; the diagnosis; significance of epileptiform attacks; headache in brain tumor not always constant; localization of lesion in right motor area; technic of exploratory operations on the brain; necessity of co-operation between neurologist and surgeon; prognosis in brain tumor.

Dr. Bevan: I shall operate upon a patient this morning upon whom Dr. Thor C. Rothstein has made a diagnosis of brain tumor situated in the right motor area. We shall make this a joint clinic. Dr. Rothstein will present to you the diagnostic side of the case, and on the basis of his diagnosis I shall proceed to operate and expose the area in which he believes the tumor is located. If the tumor is found, we shall remove it if that is possible, or do the palliative operation of decompression if the conditions of the case seem to make such a procedure desirable. Dr. Rothstein will give you the diagnostic side of the case.

Dr. Rothstein: The patient is a married woman, forty years of age. She belongs to a healthy family. It is, however, possible that her grandmother, who died at the age of thirty, suffered from epilepsy, but our information about the grandmother is too fragmentary to allow any decided opinion about the nature of her disease. The patient herself has, ever since her childhood, suffered from periodical attacks of headaches (sick headaches), and after the menstruation started, in her thirteenth year, she frequently suffered from severe headaches during the menstrual periods. The attacks of headache would last about twenty-four hours, and were frequently severe, and she usually vomited during the attack. In the intervals between the headache attacks she enjoyed good health.

She married, and when she became pregnant (in her thirtieth year) she suffered intensely from headaches, vomited continuously, had to keep to her bed, and aborted in the second month of her pregnancy.

After the pregnancy her attacks of headache became more regular, coming on practically every month at the time of menstruation. In June, 1913, she was then thirty-four years old, she had a typical epileptic convulsion, coming on in the night while she was sleeping. This convulsion was followed by a severe headache which lasted for fully twenty-four hours.

In December, 1913, she had a second convulsion, also in the night. During the year 1914 she had four convulsions, one in each of the months of March, June, July, and August; all of them were preceded by a peculiar epigastric sensation, the first three coming on in the night and the fourth in the afternoon. All the convulsions were followed by severe headaches, lasting, as in the case of the first convulsion, for about twenty-four hours. Between the convulsions she suffered from small attacks in which consciousness was not lost. She would suddenly experience a peculiar sensation in the epigastrium, become pale, and feel "stupid." After a few seconds the sensation would pass off and she would feel well. Of such attacks of "petit mal" she would have sometimes several in each day.

In 1914 she was placed upon a treatment consisting of diet and bromids. The convulsions stopped, but the attacks of "petit mal" and of headaches did not disappear, but became much less frequent.

In March, 1915, she entered the Presbyterian Hospital of Chicago, where I examined her. The pupils were equal and reacted normally. Eyegrounds were normal. No paralysis was found in any of the muscles of the body. The reflexes were all normal and the sensation was normal. A slight Dalrymple symptom was present, but pulse was normal and no tremor existed. The spinal fluid was free from globulin and albumin was not increased. The Lange test did not show any reduction of goldsol solution and only 4 to 6 cells were found in 1 mm. Wassermann test on blood and spinal fluid was negative. After the spinal puncture she suffered from severe nausea, vomiting, and violent headache, which lasted for more than a week, although she was kept in bed. As she suffered from epileptic attacks and always had been suffering from severe migraine the headache was not at this time considered of any sinister significance.

This is, in short, her history up to March, 1915. The history and the result of the examination left me, as a last choice, the somewhat unsatisfactory diagnosis of so-called genuine epilepsy.

I did not see her from March, 1915, until March, 1919, when she again entered the Presbyterian Hospital and Dr. J. B. Herrick referred her to me. Her history during this interval is, shortly, the following: As long as she adhered to the régime mapped out for her and took bromids, averaging about 45 grains in twenty-four hours, she was free from convulsions, and the "petit mal" attacks as well as the migraine attacks were few, but as soon as she stopped the bromids she would have numerous attacks of "petit mal," the migraine attacks would become as they used to be, and the convulsions would reappear. In 1917 for some reason she stopped taking medicine. The convulsions now became more frequent, but gradually they occurred less and less frequently. The "petit mal" attacks remained frequent. During the year 1918 she had one convulsion about every three months, but the "petit mal" attacks occurred five to fifteen times a day.

In December, 1918, a new feature was added to her sufferings. Immediately after some of the "petit mal" attacks she would have severe pain starting in the back of the head and spreading up over the top of head until it reached the forehead. The pain only lasted a short while. When she first started to suffer from these intense pain attacks they occurred only after a couple of the "petit mal" attacks each day. Gradually the pain attacks increased in number and intensity and vomiting would occur during them. One month after the onset of the pain attacks they had increased to such a number that they had become practically constant and remained so for four days. Then she was free from the pain attacks for four to five days, but they came on again and gradually increased in frequency until she, after another four or five weeks, had the headache constantly for a whole week. Again she had a few days of relief before she entered into a third period of gradual increase. She entered the hospital during this period. During the week she has been here she had intense headache constantly for three days, followed by a day free from headaches. But next day she had intense headache for several hours. Vomiting has occurred a couple of times during the headache attacks. During the last two months both she and her husband have noticed a tremor and shaking of her left arm, coming on sometimes when she was using the arm. They both, however, stated that she had been able to use the arm practically as well as before the onset of the tremors.

Physical Examination.—The patient is well nourished and strongly built.

The pupils are wide, the right one somewhat wider than the left. Both pupils react to light and accommodation.

Eyegrounds show moderately choked disks. Vision is normal. There is a distinct but partial paralysis of the left half of the face.

The left eye shows lagophthalmos and cannot be closed as strongly as the right. The left corner of the mouth cannot be moved voluntarily as far to the side as the right corner of the mouth. When she laughs emotionally the left corner of the mouth moves nearly as far to the side as the right. The left masseter does not form as great a protrusion as the right when she bites. The left half of the soft palate hangs a little lower than the right half, but both halves move about equally well. The outstretched tongue does not deviate from the middle line.

The left arm is markedly weaker than the right, and some resistance is felt to passive movement of the left arm, especially to extension of the wrist. Complicated movements with the fingers are not executed as well with the left hand as with the right. When she executes movements with the left arm a tremor of rather large oscillations occurs, especially at the beginning and the end of the movement. This tremor is at times much more marked than at other times. The right arm also presents some tremor when executing movements, but not as markedly as the left.

Pointing—for instance, finger to nose—is not quite accurate with the right hand, but markedly inaccurate with the left.

The tendon reflexes of the arms are lively, but a little more lively in the left arm than the right.

The abdominal reflexes are present on both sides, but more easily elicited on the right side than on the left.

At times the strength of the left leg seems less than that of the right leg; at other times the strength of both legs seems equal. Patellar and Achilles' tendon reflexes are lively on both sides and about equal on both sides. The Oppenheim, the Gordon, and the Babinski reflexes are negative (normal) on both sides. There is no tremor or ataxia present in either leg. The patient has never noticed any difference in the strength of her legs.

The testing of the sense of smell gives no clear results.

Sensation to pain, temperature, and touch is normal on all parts of the body. Astereognostic sense is not decreased on either side.

Percussion on the right frontal bone in region of the temple causes a very painful sensation, while percussion on any other part of the skull does not cause any such pain.

The temperature has been normal.

A spinal puncture has not been made recently, as the patient has a great fear of this operation on account of her experience in 1915.

We have then before us a patient who suffers from symptoms of increased intracranial pressure, viz.: severe headaches, vomiting, and choked disks. At least one of the symptoms, the headache, has shown a gradual increase in intensity and constancy since three months.

As we can practically with certainty exclude syphilis (she has never shown any specific symptoms of this disease and at least twice the serologic tests have been negative to syphilis), and as we have no evidences of any other infectious disease, the cause of the increased intracranial pressure most likely is an intracranial growth.

In our examination of the patient we demonstrated a focal symptom—the left-sided hemiplegia—which demonstrated that the brain itself must in some way be involved, and also gives us some information about the locality of the growth.

A hemiplegia may be caused by lesions in several parts of the brain, but we have before us an upper neurone lesion, and as the paralysis of the face and the arm is localized on the same side the lesion must lie above the nucleus of the facial nerve. The hemiplegia presents, however, a peculiarity in distribution. The face and the arm are about equally affected, while the leg is hardly affected at all. Such a distribution of paralysis we may find in lesions of the motor cortex. But it is not likely that we will find the tumor involving the motor cortex itself because a tumor involving the motor cortex itself would cause a greater amount of paralysis than is present in this case. Furthermore, against a localization of the tumor in the motor cortex speaks the absence of Jacksonian epilepsy. It is more likely that the tumor is situated in the proximity of the motor cortex, exerting some pressure upon or slightly involving the motor area. We cannot assume that the tumor is situated posteriorly to the motor area, because in that case the sensation should have been altered on the left side of the body, but we have been unable to demonstrate any decrease in sensation on the left side. An assumption that the tumor is situated anteriorly to the motor area is, on the other hand, plausible if we assume that it is located in such a way that it presses upon or slightly involves the centra of the face and the arm. There are no reasons for us to assume that the tumor lies deeper down in the brain, pressing upon the capsula interna, thus causing the hemiplegia. The type of hemiplegia (the leg being practically free from paralysis) present does not correspond to the hemiplegia present in tumors involving the capsula interna. Neither have we any reason to think that the thalamus is involved. The most likely place to find the tumor I therefore consider to be the part of the frontal lobe which lies anteriorly to the centra of the arm and the face. The patient presents some symptoms which I have several times found in tumors of the frontal lobe. I refer to the tremor and the ataxia of the left arm, but these symptoms are also found in lesions of other localities. I cannot say with any degree of certainty if the tumor is a cortical or a subcortical tumor. However, the pain caused by percussion of the right frontal bone can be considered a hint that the tumor may have reached the surface of the brain and involved the meninges.

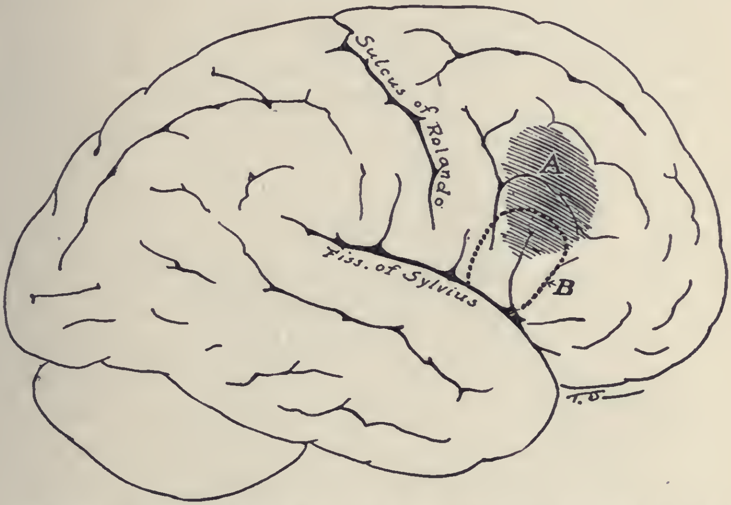


Fig. 311.—Diagram showing *A*, the area considered the most likely location for the tumor and the joint at which it probably extended to the surface of the brain; *B*, the actual location of the tumor as disclosed at operation; it involved the meninges at this point.

As we have a hemiplegia of the left side the tumor must, of course, be situated in the *right hemisphere*, and I feel convinced that the tumor is located in the right frontal lobe. The distribution and character of the paralysis and the absence of sensory disturbances make the region anterior to the arm and face centra the more likely localization. The ataxia, the tremor, and the pain caused by percussion of the right frontal bone supports, to a certain extent, this localization (Fig. 311).

The interesting question arises: How long has the tumor

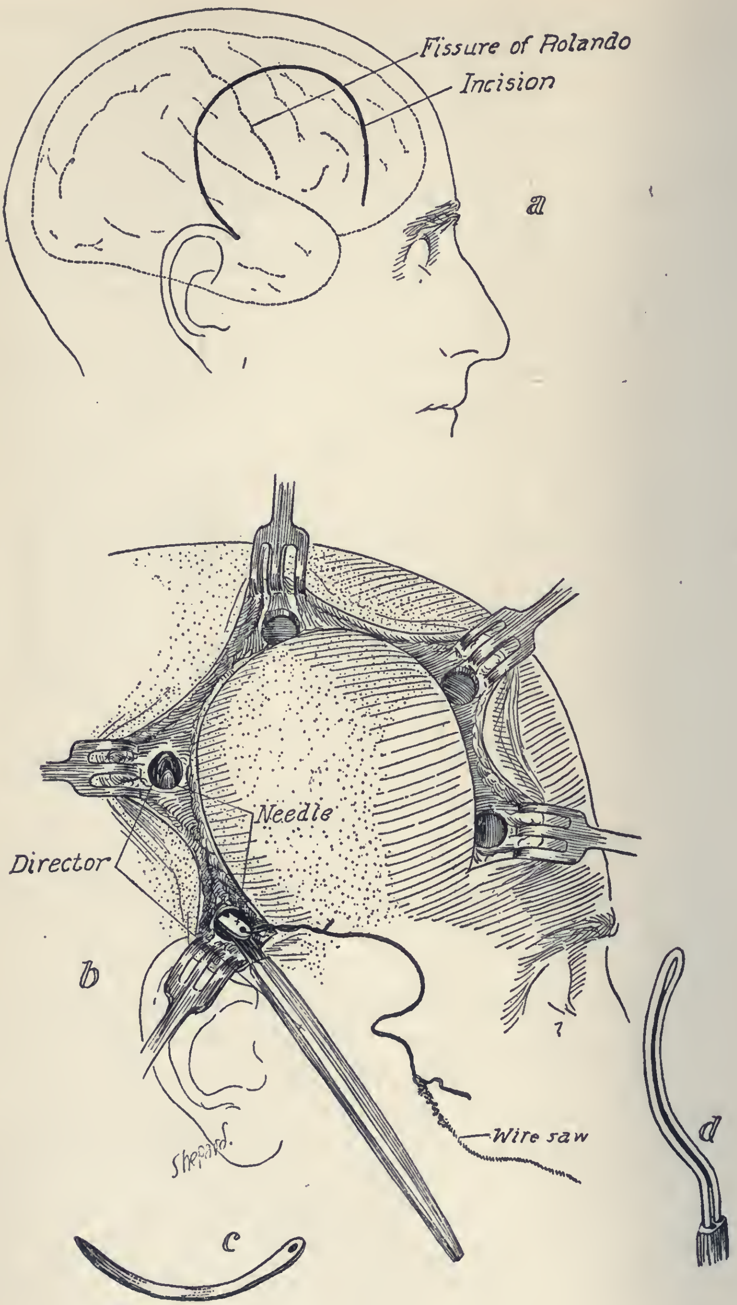

Fissure of Rolando
Incision
a
Needle
Director
b
Wire saw
d
Shepard.
c

Fig. 312.

existed in the brain of the patient? Had the tumor already started to grow in 1913 when she had her first epileptic attack, or is the tumor an incidental affair which had nothing to do with the development of the epilepsy? I suspect that the tumor existed before 1913 and, for all that we know, may have existed ever since her birth, but I am unable to give any convincing reasons for this belief.

Dr. Bevan: The patient has been properly prepared, the head very carefully shaved and sterilized. She is now thoroughly anesthetized under drop ether and we shall proceed with the operation. As Dr. Rothstein explained to you, we shall expose the area of the brain in front of the Rolandic fissure on the right side and expose also if necessary the frontal lobe and the temporosphenoidal lobe. I shall, therefore, plan an osteoplastic flap, irregularly, about 3 inches in diameter, exposing posteriorly the Rolandic area and the area in front of the center of the fissure of Rolando. I am making an omega-shaped incision through the scalp tissue large enough to enable me to elevate a bone-flap about 3 inches in diameter (Fig. 312, *a*). As I proceed I shall describe to you the technic which we have adopted in this clinic. As I divide the scalp tissue you will see that these tissues are very vascular and it is necessary to apply a large number of artery forceps to control the bleeding. There was a time when we attempted to control hemorrhage from the scalp with a rubber tube tied tightly around the head, endeavoring to obtain the same effect with this rubber constriction that we do in a bloodless operation of the extremities. My experience, however, has been that it is very difficult to control the bleeding from the scalp tissues in this way, and for a number of years I have discontinued the use of the rubber constrictor, and have relied entirely upon a large number of artery forceps accurately applied, picking up each bleeding point on both sides of the incision. As far as possible we do not grasp

Fig. 312.—*a*, Incision for exposure of motor area of cortex. *b*, Soft tissues retracted, trephine openings made and Gigli saw being carried beneath segment of bone between trephine openings. *c*, Broad, flat, blunt curved needle used to carry wire saw into position. *d*, Grooved director.

the integument in the artery forceps, but the superficial fascia just beneath the integument in which most of the vessels are situated. It is, however, occasionally necessary to clamp the edge of the skin, and I do not hesitate to do this where it is required, as there is little danger of necrosis from this procedure, even though the clamps are allowed to remain in position for a half-hour or more. The hemorrhage is now completely controlled. We have employed in our clinic for a long time a trephine and Gigli wire saw to make our osteoplastic flap. This is in a way a rather simple method and rather time consuming, and yet I believe that except for the fact that it is time-consuming it is the best method that has so far been developed. The use of the electrically driven saw for skull work has not been very satisfactory to us, and such apparatus is complicated and somewhat difficult to sterilize and is very apt to get out of order, and therefore in a general surgical clinic, where but a few head cases are done each month, I am inclined to advocate the use of the trephine and wire saw in making the osteoplastic flap.

Taking a small trephine, about $\frac{1}{3}$ inch in diameter, I make five trephine openings. The skull in this case is particularly thick and the making of these trephine openings rather tedious. I do not believe, however, that the great thickness of the skull has anything to do with the pathologic condition. We have found that skulls vary greatly in thickness independent of the pathologic condition, and that the thickness seldom has any relationship to the disease process within the cranial cavity. Having made these five trephine openings, I take a curved grooved director (Fig. 312, *d*), very smooth and blunt, and separate the dura mater from the bone in the line between these openings. I now take a blunt curved needle (Fig. 312, *c*) which is used to carry the wire saw under the bone and very gently and very carefully carry the wire saw into one of our trephine openings posteriorly and then out through the trephine opening about 2 inches above (Fig. 312, *b*). My assistant takes a rubber bulb with a glass tube which is filled with normal salt solution and keeps the saw moistened with the solution. Without using too much tension I now begin sawing our first line, and

I want to call your attention to the fact that I saw the bone through in such a way as to leave a bevel (Fig. 313, *a*, *b*), so that when we replace the osteoplastic flap there is no danger of pressing the bone down on the dura. You see that it is necessary for me to saw four lines between my five trephine openings. It is well for you to begin one of these operations with three or four new wire saws in readiness because occasionally one of these wire saws will break during the procedure. I have now completed the sawing and shall very carefully elevate my osteoplastic flap. It will be necessary to fracture the bone at the inferior border of the bone plate that I am elevating. I do this with a good deal of care, introducing a periosteal elevator first on one side and then on the other, having my assistant gently make pressure with two periosteal elevators. I take a third periosteal elevator and elevate the upper part of the osteoplastic flap very gently until I can introduce my elevator under the bone. Then grasping the osteoplastic flap with a gauze sponge and asking my assistant to continue the pressure with his two periosteotomes, I elevate the plate until I feel it yield and fracture at its lower point. I immediately take a gauze sponge wrung out of warm salt solution and surround my osteoplastic flap, and then take a pair of volsellum forceps and apply one blade to the bone and one to the scalp tissue, and then clamp the forceps together over the gauze sponge so as to prevent any separation of the bone from the scalp flap. There is little hemorrhage as I elevate the bone-flap, and as I sponge the surface carefully I find that most of this hemorrhage is from the diploë. I take a piece of Horsley wax and push it gently into the bleeding openings of the diploë and control at once the hemorrhage from that source. There is also a little bleeding from a ruptured branch of the middle meningeal artery. Taking a fine non-cutting needle and a fine piece of catgut I transfix the dura under the meningeal artery and ligate it. At the upper part of the incision there seems to be some hemorrhage from a venous sinus, or rather a vein that leads into the superior longitudinal sinus. This hemorrhage I control with some dry sterile absorbent cotton. The field is now quite dry and bloodless.

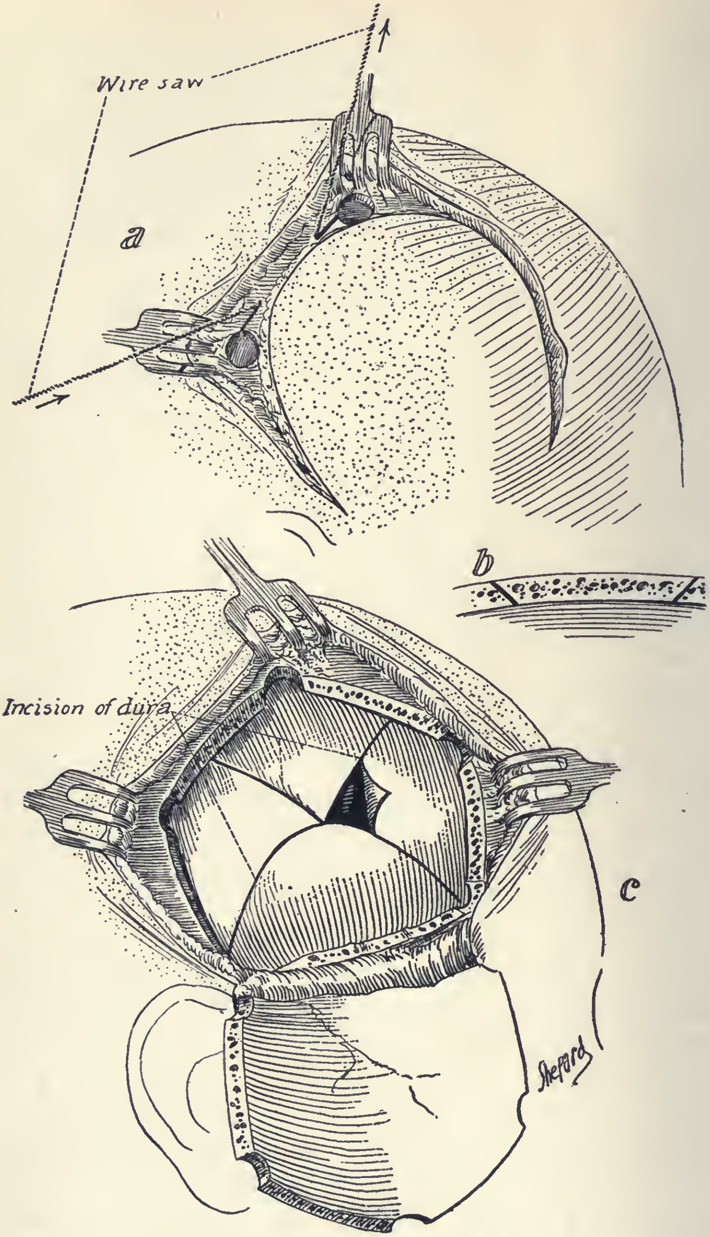


Fig. 313.—*a* and *b*, Gigli saw in action; note beveling of edge of bone-flap (*b*). *c*, Osteoplastic flap turned down and dura incised for exposure of brain.

The dura looks fairly normal. On palpation, however, I am rather inclined to believe that I can detect a difference in consistency between the anterior and posterior portions of the area exposed. I now open the dura with a curved flap incision to which I shall add two linear incisions at the upper point and fold the dura back in four pieces (Fig. 313, *c*). Turning the dura back you see, beautifully exposed, a tumor which is well outlined from the normal brain tissue. It is about the color of liver tissue and the differentiation between that and normal brain tissue is very marked as far as the color is concerned. On palpating it, however, with my gloved finger there is not very much difference to be determined by palpation. The tumor tissue, if anything, is a little firmer and less yielding than the brain tissue. The tumor involves the area Dr. Rothstein so beautifully drew for you before I opened the skull. It involves the area in front of the middle third of the Rolandic fissure and has continued forward into the frontal lobe. Posteriorly, the tumor is irregular, about the size of a silver dollar at least, and it involves about that much of the cortex. The depth of the tumor is, of course, yet uncertain and unknown to us. Anteriorly the tumor fades into brain tissue and there is no sharp line of demarcation. Taking a blunt, well-rounded periosteotome I attempt, beginning posteriorly, to find a line of cleavage between the tumor and the normal brain tissue (Fig. 314). You see that the tumor bleeds very easily, and as I continue the separation with the greatest possible care the hemorrhage is so great that I have to stop and pack the wound with dry absorbent cotton and use a slight amount of pressure to control it. Leaving the cotton in for about five minutes, I now remove it; the hemorrhage has ceased and I continue the effort to enucleate the tumor. I am able to remove several cubic centimeters of the tumor, but as I continue the separation anteriorly and inferiorly I find that the tumor becomes diffuse and that it is impossible to differentiate it from the brain tissue. It will be impossible, therefore, for me to make a clean and complete enucleation of this growth. Dr. Rothstein, after looking at the tumor, tells me that, from the gross appearance, he believes it is an endothelioma, and that if possible we should remove it. You all realize that removing a tumor from the brain as we are doing now is a very different proposition from removing a tumor from the breast, for instance, because we are anxious to do as little injury as possible to the brain tissue, and the sort of block dissection that would be permissible in a breast operation is, of course, here entirely out of consideration.

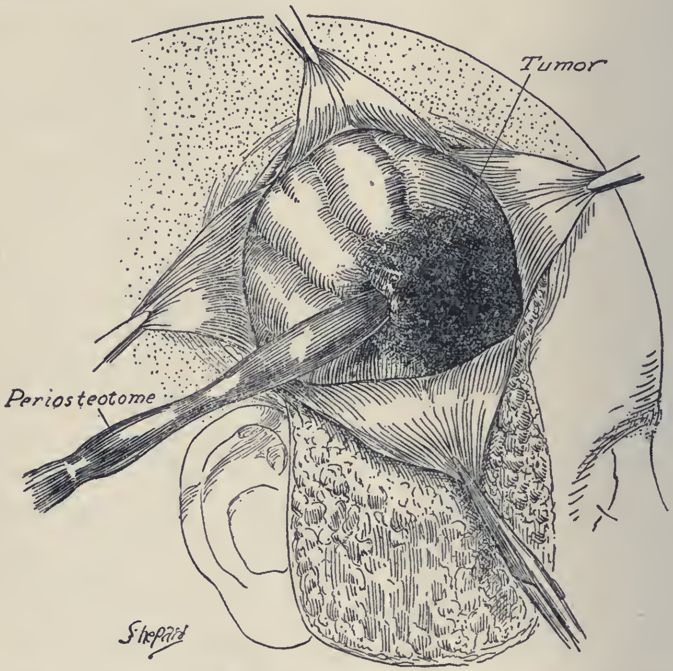


Fig. 314.—Attempt to dissect tumor from brain tissue by blunt dissection with periosteotome.

The patient's condition is fairly good and we have removed the tumor as widely and as thoroughly as I fear we are warranted in doing, and yet I am quite certain that we have not removed it all and that the conditions are such as to make it undesirable to proceed further with the dissection. I believe that we should combine this partial extirpation with a decompression operation, and I shall, therefore, remove a large area of bone. I remove, with a pair of rongeur forceps, the bone in the temporal fossa. This will give us a permanent opening in the bone about $2\frac{3}{4}$ inches long and about 2 inches wide and I shall not close the dura mater. I obtain in this way the full effects of a decompression operation. I replace my osteoplastic flap and remove the artery forceps from the edges of the incision and approximate the incision with seven or eight fine silkworm-gut sutures and close the balance very accurately with fine silk. We shall employ no drainage. We shall dress the wound with dry sterile gauze and a sterile gauze roller accurately applied, and over this a starch bandage to prevent any displacement of the dressings. I want to say that I believe this dressing should be changed at the end of twenty-four hours and the silkworm stitches removed at that time. Three or four days later every other one of the interrupted black silk stitches should be removed and the balance removed by the sixth or seventh day. The patient is in very good general condition at the close of the operation.

After-history.—Histologic examination showed that the tumor was an endothelioma. The patient was unconscious for the greater part of the first twenty-four hours, but gradually regained consciousness so that she could take liquids and some nourishment. Wound healing was complicated by the escape of cerebrospinal fluid and some brain tissue, the stitches were removed as I had suggested, first the silkworm-gut and then the black silk, in two different sittings. After operation there was paralysis of the left side, especially of the left hand.

As to the ultimate prognosis, one must regard the operation as palliative. From the standpoint of accuracy of diagnosis the case is most satisfactory, but from the standpoint of an ultimate and complete recovery, however, one must regard it as a case in which the surgical therapy is simply palliative, and if of any benefit, of temporary benefit. The epileptic convulsions may be controlled or prevented entirely and the headaches will probably be relieved and the eyesight improved, but the infiltrating character of a part of the growth makes it certain that there will be a continued growth of the tumor which will lead ultimately to the death of the patient. Dr. Rothstein and I have considered the possibility in this case of using radium or of employing the x-ray, and I am not sure but what in a similar case it would not be wise to introduce a flat disk with 50 mg. of radium at the time of operation and leave it in twenty-four hours and see if in that way we could not eliminate the diffuse portions of the tumor that could not be removed surgically. I do not know how much work has been done along these lines, and yet it is certainly a suggestion that might properly be considered and tested out in a group of cases.

I would like to make two comments on the basis of this case: first, the necessity of handling these cases in general as combined cases by the general surgeon and the neurologist, it being, of course, often necessary to call in the service of the ophthalmologist or the otologist in the making of the diagnosis. On the whole, these cases must be handled as a piece of team-work by the general surgeon and the neurologist. A few of our best men have specialized in neurologic surgery and have become very competent neurologists, so that they themselves can dispense with the services of the neurologist and are competent to take complete charge of both the diagnostic and therapeutic side of these cases. It does not, however, seem probable that there will be developed a speciality of any considerable number of brain surgeons, and so naturally for the most part throughout this country and throughout the world, in fact, these cases will have to be handled in the general surgical clinics by competent general surgeons and their neurologic colleagues.

The second point I would like to call your attention to is a fact well illustrated by this case, that even where the neurologist can make an accurate diagnosis, it often happens that, even when the tumor is found, it is often so located or of such a character that it cannot be successfully and completely removed so that the patient can be permanently cured and restored to normal. It certainly would be safe to say that considerably less than 10 per cent., possibly not more than 5 per cent., of brain tumors are so situated and are of such character that they can be diagnosed, removed, and the patient cured. In other words, only from one in twenty to one in ten of all brain tumor cases can be accurately diagnosed, operated upon, and cured. That fact, and I believe it is fact, limits the number of satisfactory cases, and it is a condition which no amount of improvement in diagnosis or in surgical technic will ever modify; because of these insurmountable conditions we can never look forward in the development of brain surgery to anything like the satisfactory results which we obtain in many other fields, notably in the abdomen. It is difficult to be enthusiastic and optimistic about our results in brain surgery, and yet I would not want to leave you with feelings too pessimistic or with anything like a hopeless feeling in connection with this work because some of the cases are most brilliant successes, and many of the cases which we cannot cure are very greatly relieved by the palliative operation of decompression. Therefore, it is our duty to continue this work and to give these patients the small possibility of permanent cure and the larger possibility of palliation that modern surgery affords.

CLINIC OF DR. ARTHUR DEAN BEVAN

PRESBYTERIAN HOSPITAL

MULTILOCULAR CYSTADENOMA OF THE LIVER

Summary: A patient, twelve years after hysterectomy for fibroid, presenting multiple smooth rounded tumors in the upper abdomen; differential diagnosis; exploratory puncture of cysts and closure without drainage.

THE first patient I shall operate on this morning is a woman of about fifty, who came to me twelve years ago with a large fibroid of the uterus. I did a hysterectomy, leaving simply the cervix, and she made a very satisfactory recovery. She had no trouble of any kind until about three years ago, when she noticed an enlargement in the upper abdomen in the median line just below the ensiform cartilage. A little later she noticed a second enlargement on the left side about opposite the umbilicus. This seemed to be about the size of an orange and she could outline it very distinctly herself. The enlargement in the midline was more diffuse, a firm and bulging prominence between the umbilicus and the ensiform cartilage. Her general health has been good. Within the last three months she has several times had some stomach distress, accompanied with an occasional attack of vomiting, but she has been able to keep about with her work and has not been incapacitated in any way by her abdominal condition. I have had her under observation for several days, and I confess I am not able to make a diagnosis as to the pathology of these enlargements. I have looked up her old hospital record and find that the tumor removed was a fibroid and that microscopic section of it was made, showing that it was a simple fibroid and that there was at that time no evidence of malignancy.

I have thought of a number of possibilities. It is natural to think that the tumor which I removed may have been malignant and that the present tumors are secondary to the primary neoplasm. The length of time that intervened, however, between the hysterectomy and the development of these tumors, of course, is a strong argument against malignancy. The fact, too, that these tumors have existed now for three years and that her general health is excellent is also a strong argument against their being malignant. I thought, in the second place, of the possibility of a papilloma of the ovary and that these were secondary papillomatous growths. A bimanual examination of the pelvis, however, fails to reveal any pelvic enlargement, and this speaks strongly against such a possibility. In discussing the matter with the patient I told her that I regard the present condition as being independent of the fibroid tumor which was removed twelve years ago, and that I believe that it is a benign and not a malignant process, but as to the exact anatomic location of the present lesion and its pathologic character I am quite unable to come to any definite conclusion.

The patient is now etherized and I shall make a laparotomy between the ensiform and the umbilicus and inspect the character of these masses. I have simply told the patient that I believed that an exploratory laparotomy was necessary to make a diagnosis, and that this should be done, and if at operation conditions were found which warranted our doing a radical operation, of course, we would do this under the same anesthetic.

Opening now into the peritoneal cavity and holding the line of incision apart with retractors, you see that I expose a large multilocular cyst (Fig. 315). I shall extend the incision a little below the umbilicus so as to gain freer access to the lesion. On examining this cyst carefully, you see that it is composed of a number of cysts, apparently eight or ten or more in number, and that these involve the liver and invade the area of both the right and left lobe of the liver just beneath the round ligaments. One thinks naturally of the possibility of hydatid cyst of the liver. Walling off this cystic tumor from the rest of the abdomen with several abdominal pads, I shall open one of these cysts and inspect its contents. You see, as I open this large cyst, a very clear watery fluid pours out, and as I empty it completely, you see that there are no daughter cysts. I shall now open several more of these cysts, and you see that the second cyst opened has the same sort of clear fluid contents. The third cyst, however, contains a brown colored liquid which is probably the result of hemorrhage into it. Putting my hand into the abdomen I feel a large cyst extending down from the liver on the left side and I can readily bring this out of the abdomen. This is the tumor that we could feel distinctly on the left side about opposite the umbilicus. It projects from the lower border of the liver in such a way that I can remove it completely, and I shall do this for the purpose of examining the cyst wall histologically. Extending my examination to the upper surface of the liver, I find between the diaphragm and the right lobe of the liver two very large cysts, as large as my fist. I incise these and empty their contents, and find that they contain the same clear fluid.

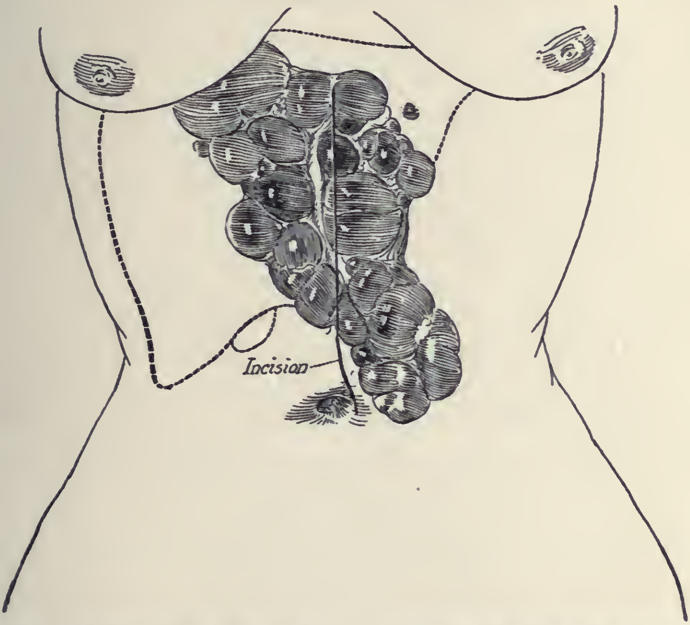


Fig. 315.—Multilocular cyst of liver. Diagram illustrating approximate form and location of tumor.

This case is a very unusual one and we cannot make an absolute diagnosis even now that we have this multilocular cyst immediately under our inspection. One thinks of several possibilities. First, a hydatid cyst without daughter cysts, and yet I do not believe that this is a hydatid cyst. The second possibility that occurs to me is a congenital multilocular cystic disease of the liver that has been found in a number of cases associated with cystic disease of the kidneys. I shall, therefore, examine the kidneys and see if there is any cystic disease of those organs. Introducing my entire hand into the abdomen, I examine first the right kidney and find it perfectly normal, and then the left kidney and find that is also perfectly normal. I examine also the pelvis and find nothing in the pelvis. The uterus, of course, is gone, having been removed at the previous operation. The gall-bladder is normal. The pancreas is normal. The stomach and duodenum are normal. There are no enlarged lymphatic glands to be felt, and there is no evidence of any secondary deposits of any sort under the peritoneum. I am forced to the conclusion that this is a multilocular cyst adenoma of the liver involving both the right and left lobes of the liver and the round ligament, and that it has developed from an embryonal rest associated with the round ligament, and that it is, in fact, the same pathologic condition that we find in multilocular cysts of the ovary, and that it is a true neoplasm from an embryonal rest. A number of such cases have been reported in the literature, and I shall, therefore, venture this diagnosis as the most probable diagnosis of the case until we have obtained a microscopic examination of the cyst wall that I removed.

The particular and important question that now confronts us is what to do with this growth. It is evidently impossible to remove these multilocular cysts from the liver. These so invade both the right and left lobe that an operation that would radically and completely remove them would certainly be fatal to the patient. I am, therefore, inclined to do what has been done in cases of multilocular cysts of the kidney. I shall split open one after the other of these and empty out the contents, with the hope that it will be of some service to the patient in

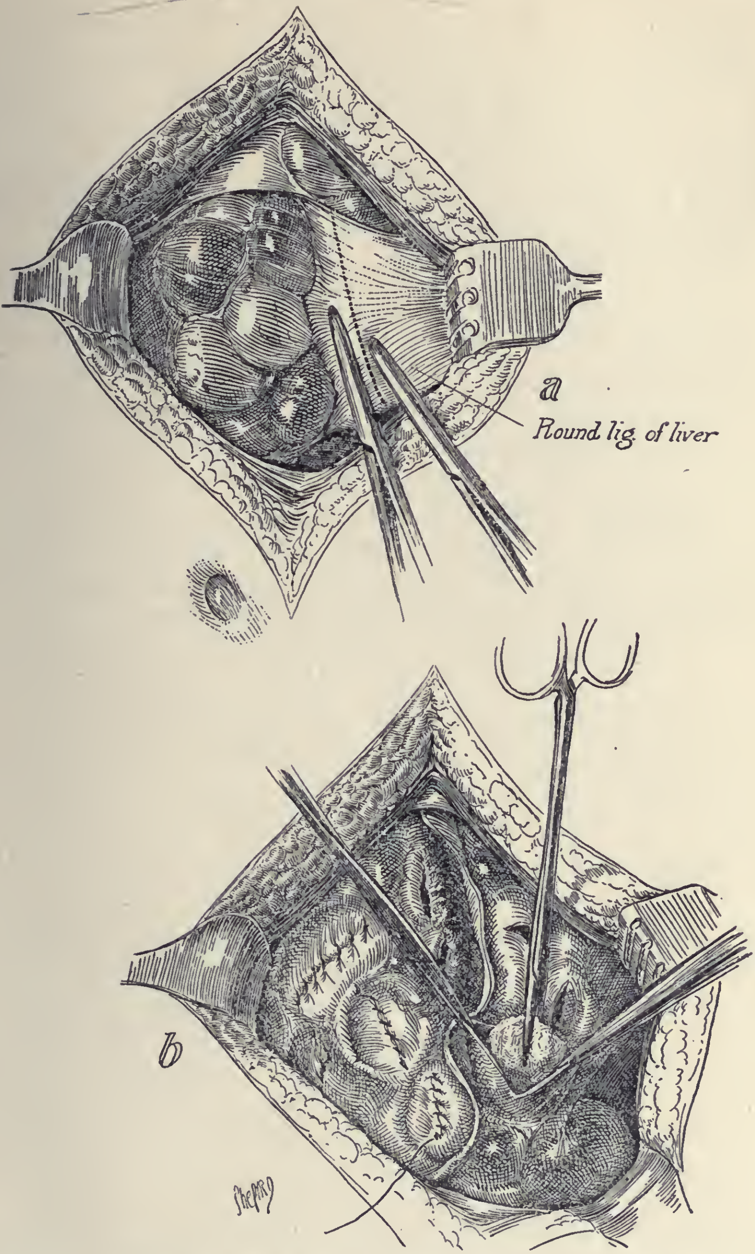


Fig. 316.—Multilocular cyst of liver. *a*, Round ligament of liver clamped and cut. *b*, Cyst opened, sponged out, and closed with fine catgut.

reducing the size of the neoplasm and relieving the pressure. I question very much whether it will be of any definite service, but still in view of the fact that the same principle has been applied, and occasionally successfully, in polycystic disease of the kidney, I think we are warranted in adopting it in this case in view of the fact that there is no other surgical therapy that might be considered.

After splitting open the cysts and emptying out the contents I am going to sew up the cyst wall with fine catgut and attempt to obliterate to a certain extent the cavity of each of the cysts in that way, but I am doing this more particularly so as to leave a perfectly clean, smooth peritoneum, because I do not intend to introduce any drainage, but to make a complete closure of the abdominal incision (Fig. 316).

After-history.—The woman made a good recovery from the operation. The microscopic examination showed the tumor to be a cyst-adenoma. I am giving her *x*-ray treatments with the hope that they may prove to be of benefit.

EPITHELIOMA OF THE LOWER LIP

Summary: Technic of plastic operation on lower lip for carcinoma under local anesthesia; operation palliative in the majority of cases in the presence of glandular involvement; epithelioma of lower lip not suitable for x-ray treatment without surgical removal; importance of excision of carcinomatous tissue *en bloc.*

The patient whom I shall operate on this morning is this man of about sixty years of age with this large epithelioma of the lower lip. The clinical picture is quite characteristic and leaves no doubt as to the diagnosis, but we have had some sections of the tissue removed under local anesthesia and they show a typical epithelioma. The man has been a pipe-smoker for years and we can accept that as being probably the etiologic factor. The Wassermann is negative. His general condition is good for a man of his age. There is no evidence of involvement of the regional lymph-glands in the floor of the mouth. They are not palpable.

I want to demonstrate to you the technic which we have employed for a great many years in making a complete lower lip removal. This is the plastic operation which I was taught when I was a medical student by Gunn, who then had charge of this clinic. We, however, have modified it in this way, that we are now doing the operation under local anesthesia instead of employing a general anesthetic. I tell these patients, so far as the anesthetic is concerned, that we will be able to do the operation with not very much more pain than having a shave; certainly with less sensation than being shaved with a dull razor, and if the technic of local anesthesia is perfect in a case of this kind, there is practically no sensation except the introduction of the first needle. This is not at all an exaggerated statement, because in this operation we can completely anesthetize the entire field so that the patient practically has no sensation whatever. The use of the local anesthetic makes the operation very much simpler and very much safer, and because of the addition of adrenalin there is much less hemorrhage under local than under a general anesthetic.

The patient has been thoroughly prepared by having the face carefully washed with tincture of green soap and alcohol. He has used a mouth-wash to clean his mouth out thoroughly, consisting of 1 part of alcohol, 1 part of peroxid, and 2 parts of water. This makes a very efficient mouth-wash. The teeth have been thoroughly scrubbed with a brush. They are, however, not in very good condition and later will need the attention of a dentist.

Taking a very fine hypodermic needle with a small syringe I inject about ½ inch from the margin of the epithelioma 20 or 30 drops of apothesine, ½ of 1 per cent., to which we have added adrenalin sufficient to make it 1 : 100,000. In the area made by the first injection I now introduce a larger needle, and using a large syringe I infiltrate the entire lower lip, and pretty extensively, probably the size of a silver dollar, the tissues at the angle of the mouth. I infiltrate also the upper lip and cheek, and a narrow triangular area of the cheek just outside of the angle of the mouth and above the angle of the mouth. I infiltrate, also, the mucous membrane of the lower lip and the tissues well down over the tip of the chin (Fig. 317, *a* and *b*). You will notice that the infiltration is sufficient to distend the lower lip to about twice its normal size and the tissues of the cheek also where we have made the infiltration. Beginning now with a sharp knife and compressing the coronary arteries at the corner of the mouth on the right side, I cut out a big V- or Y-shaped block of tissue involving almost the entire lower lip, going widely, at least ¾ inch, from the epithelioma. You will notice that the patient has no sensation of pain whatever as we remove this big block of tissue. There is very little bleeding. The coronary arteries near the mucous membrane of the lip bleed, but are easily grasped with artery forceps, and two smaller vessels at the lower part of the incision near the chin also are controlled with artery clamps. I now make an incision at the angle of the mouth directly outward about ¾ inch in length. This in-

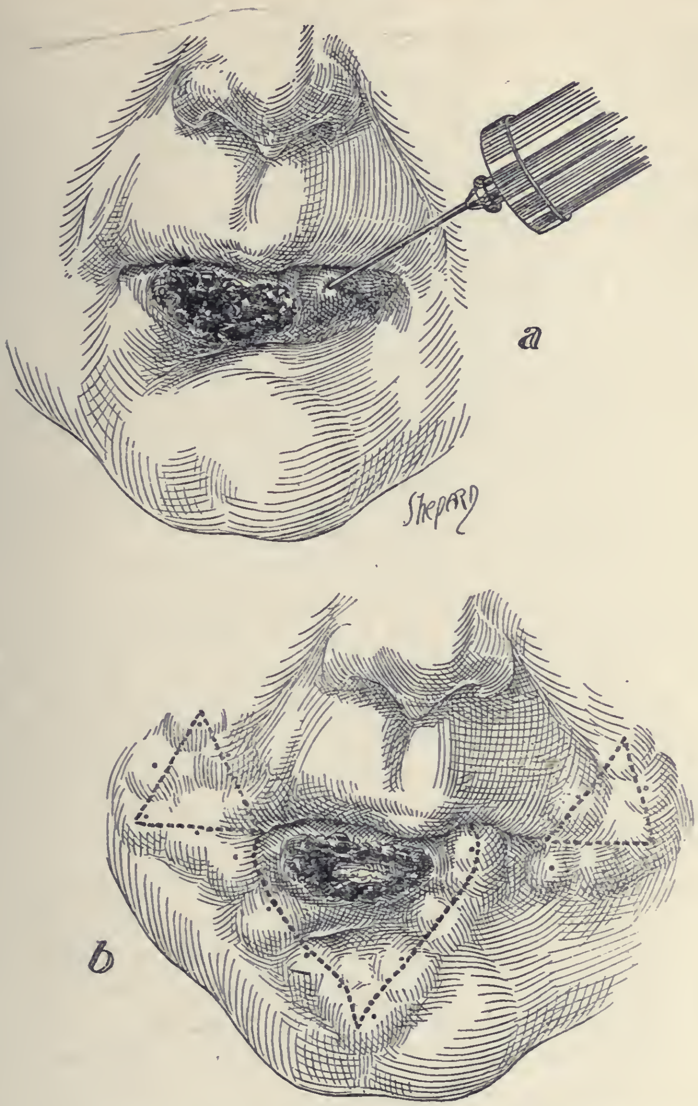


Fig. 317.—Carcinoma of lip. *a*, *b*, Infiltration of tissues with apothesine solution; injections indicated by dotted lines.

cision divides through the skin, muscle, and mucous membrane. I then add to this two incisions, making a triangle at the corner of the mouth. These last two incisions, however, simply include the skin and superficial fascia. I now make the same sort of a triangle on the other side (Fig. 318, *a*). The incisions of the plastic operation are now complete and we are ready to close the defect. This is best done by closing first the triangles at the corner of the mouth. I introduce here one silkworm-gut stitch at the base of the triangle and tie it. This, as you see, slides the two flaps toward the median line. I now introduce one silkworm-gut, bringing the big V-shaped incision of the lower lip together. The next step of the procedure is to sew the mucous membrane of the cheek and of the skin together at the angle of the mouth, making a vermilion border for the new lip. This we shall do with a fine black silk suture. I shall next introduce the skin silkworm-gut stitch about the center of the big V-shaped incision of the lower lip. There remains simply the closing, very accurately, of the skin of the V-shaped incision of the lower lip with fine black silk suture, and then everting the new lower lip and closing very accurately the mucous membrane with four or five silk sutures, and introducing two interrupted silk sutures in order to close completely the triangular areas at the corners of the mouth (Fig. 318, *b*). This completes the operation, and, as you see, makes a surprisingly good lower lip with very little deformity, the immediate result being excellent, but the result within six weeks you will find will be much better. There will be quite complete muscular control and we have avoided any injury to the nerve supply of the flaps, so that six or eight weeks from now there will be little deformity and very little loss of function of the mouth and lower lip. Taken altogether, this is the most satisfactory plastic that we can make for a cancer of the lower lip.

There are several facts that I would like to bring out clearly in regard to this operation. First, I believe that the most important thing that can be done with cancer of the lower lip is a very wide excision of the primary lesion, and that that gives the patient the best prospect of a cure. In the second place, my experience has led me to believe that when the lymphatic glands at the floor of the mouth are involved there is little prospect of a permanent cure, even though we make a wide excision and

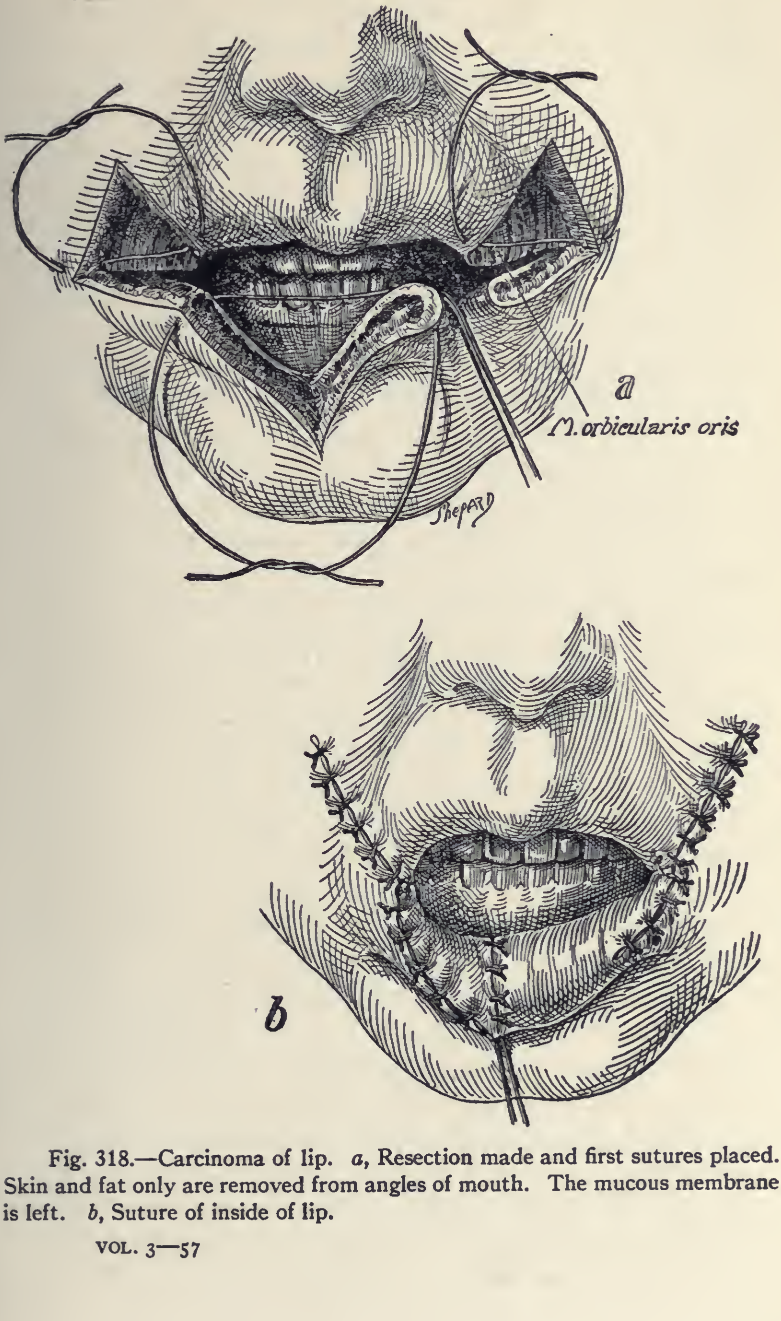


Fig. 318.—Carcinoma of lip. *a*, Resection made and first sutures placed. Skin and fat only are removed from angles of mouth. The mucous membrane is left. *b*, Suture of inside of lip.

make a radical extirpation of the glands and fat at the floor of the mouth. Our experience has been that where the regional glands are definitely and grossly involved the operation is almost always simply palliative. We do not accept the proposition that the glands at the floor of the mouth should be removed in all of these cases, and our reason is this: If they are not already involved, the safety of the patient depends upon a wide excision of the primary lesion. If they are involved, an extensive dissection at the floor of the mouth simply gives an added palliation, but not much if any prospect of a cure. I think it is well to keep in mind in operating on cases of carcinoma the way in which the cancer grows and invades tissues. Take a case like this patient. The cancer begins in the lower lip. It remains as a local lesion for a certain period of time and then it extends along the lymphatic vessels by a process of growth, just as a vine grows along the ground, and I frequently use the parallel of the growth of the pumpkin vine. The cancer cells do not float along the lymphatics. They grow along the lymphatics until they reach the nearest lymphatic gland. There they grow very rapidly, so that within a short time there is a tangible enlargement of the involved lymphatic glands. The process then continues from these first lymphatic glands along the lymphatic vessels to the next group of lymphatic glands, and eventually, of course, at some point the carcinoma undergoes degeneration, softens, and breaks into a blood-vessel, and then the carcinoma cells find their way into the blood stream and are carried to distant parts of the body, deposited, and produce general metastatic growths.

The hope of a cure of cancer anywhere in the body is that the patient can receive the benefit of a radical operation at a time when the cancer is still limited to the primary lesion and before it has involved the lymphatics. When the cancer is still limited to the primary lesion and the lesion is so situated that anatomically it can be widely removed, the prospects of curing the patient of cancer are excellent. When, however, the lymphatics are already involved, and especially when the nearest lymphatic glands are palpably enlarged, there is little prospect that any operation can permanently cure the patient. Any operation, therefore, that is planned when the cancer has already invaded the regional lymphatic glands should be so planned that the surgeon should remove in one block of tissue the primary lesion and the lymphatics involved and an intermediate block of tissue between the primary lesion and the enlarged lymphatics, because in this intervening block of tissue will be found a fine growth of cancer cells along the lymphatic vessels. If we leave this intervening block of tissue, the patient may be benefited temporarily by the operation, but the carcinoma cells still remaining will continue to grow and kill the patient ultimately of carcinoma. Let me illustrate this point by applying these facts to cancer of the tongue with a palpable definite involvement of the lymphatic glands at the floor of the mouth. If in such a case we remove the cancer of the tongue widely and thoroughly and then at a later operation dissect out the lymphatic glands in the floor of the mouth, you may be sure that this will simply be a palliative operation, because we would in such an event leave a block of tissue containing lymphatic vessels, along which the cancer had grown from the tongue to the lymphatic glands, at the floor of the mouth. A few years ago surgeons overemphasized the importance in cancer work of removing the lymphatic glands into which the cancer-bearing area drained. This was carried to an absurdity, especially in connection with radical operations about the uterus, where we were taught for a short time that taking out the lymphatic glands along the iliac vessels was a matter of great importance in securing a permanent cure in carcinoma of the uterus. Of course, in cancer of the breast, where we can easily remove in one block of tissue the mammary gland and underlying pectoralis major muscle and axillary lymphatics and fat, this should be done, I believe, as a routine, but even here we must remember that we should not place too much importance on the removal of the axillary lymphatics glands, because these are but a part of the draining lymphatics of the mammary gland, the mammary gland draining into the anterior mediastinum and into the posterior mediastinal glands. These, of course, are beyond the reach of the surgeon's knife.

I am inclined to give this patient the benefit of a short course of *x*-ray treatment, let us say, eighteen to twenty exposures during the next two or three months, given by an expert, of course, without subjecting him to the risk of burns. I think the prognosis in this case is fairly good, probably about 50 per cent. of chance of a permanent cure. It is too bad, of course, that the patient did not have this operation done months ago, because in early epithelioma of the lower lip the prospects of cure by radical excision are excellent and probably will be as high as 80 per cent. or more.

In regard to handling these cases without radical operation and with the use of *x*-ray alone, I would like to say a word. I have seen many superficial epitheliomas cured by the *x*-ray, but I do not regard epithelioma of the lower lip as a condition in which the *x*-ray should be used alone, and even in small epitheliomas of the lower lip I believe the safety of the patient and the interests of the patient are best subserved by doing a radical excision and then using the *x*-ray as a means of after-treatment.

You will notice that we have not applied any dressing in the way of gauze or dressing of any kind in this case. I simply touch the line of incision with a small cotton applicator soaked in tincture of iodin. We shall have the man use the same mouthwash several times a day that we used in cleaning out his mouth before operation. We shall instruct him to keep his hands from it and every day or two to touch the line of incision with a little tincture of iodin. If there is any slight oozing from the incision we shall have the nurse instruct the patient to sponge it with a piece of sterile gauze simply to absorb the moisture. These cases are very much better without any dressing and simply exposed to the air.

Although this operation has looked very formidable, we shall have the patient sitting up this afternoon, and he will sit up every day he feels inclined to do so. Of course, we shall be compelled to feed him on a soft diet. We shall remove the silkworm-gut stitches about the fifth or sixth day and about every other one of the interrupted silk stitches, and leave the balance until the ninth or tenth day.

After-history.—The patient made an excellent recovery. He had been in the habit of wearing a mustache and a beard, which he let grow, so that three months after operation there was no visible scar and little or any evidence of either the cancer or the result of the operation.

CLINIC OF DR. A. J. OCHSNER

AUGUSTANA HOSPITAL

THREE CASES ILLUSTRATING CERTAIN BENIGN LESIONS OF THE PAROTID GLAND

Summary: Case I.—Salivary calculus; treatment by excision of parotid gland, inflammatory changes about site of calculus rendering simple removal of calculus inadvisable; dangers of the operation; choice of incision; how to avoid the facial nerve.

Case II.—Gunshot wound in parotid region; repair of defect following evulsion of parotid gland and portion of lower jaw; transplantation of fat and fascia.

Case III.—Tuberculosis of the parotid gland; treatment; importance of clean, thorough dissection; prime necessity of removing infected tonsils and adenoids; dressings; the use of antiseptics.

CASE I.—This patient is a doctor aged forty-nine. His family and past histories are negative.

Twelve years ago he noticed that once in a while his right parotid gland became slightly enlarged and painful; at the same time he noticed that saliva from that gland did not empty freely into the mouth. He could feel with his finger a little hard body located in the middle portion of the gland; it disappeared when a small stone came out into the mouth. This stone was about 3 mm. in length. In May, 1918, the gland became very much enlarged and painful and the secretion stopped completely. The patient was operated and the gland was found full of saliva. Steno's duct was opened and a little stone removed. Following operation he had an infection with abscess formation, the pus discharging through the wound. At present the saliva does not flow into the mouth. The wound is fistulated, saliva and some pus coming out through it. The gland is enlarged and at times painful.

His appetite is good; habits negative.

Examination.—There is a vertical healed surgical incision, 4 cm. long, over the middle of the right parotid gland, and pressure on the posterior portion of the gland reveals the presence of a very minute fistula in the middle of the old operative scar mentioned above. The clear watery parotid secretion can be readily expressed through this fistula by manipulation of the gland.

The right parotid is enlarged approximately to three times its normal size. It is not tender to palpation and a hard foreign body or calculus, roughly the size of a walnut, can be definitely outlined in the parenchyma of the gland, lying posterior to the angle of the right lower mandible.

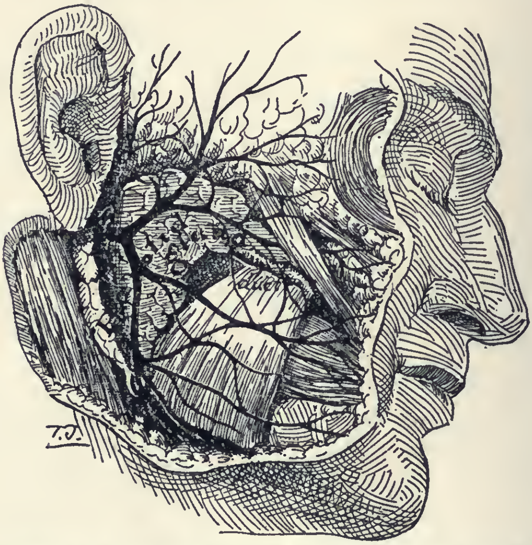


Fig. 319.—Anatomy of the parotid region, showing branches of the facial nerve and Steno's duct.

Mouth.—There is an old scar on the buccal mucosa opposite the second upper molar tooth on the right side, the site of the insertion of a rubber drainage-tube. The submaxillary glands are not enlarged. There are no palpable cervical lymph-glands.

Judging from the patient's present condition and from the past history, it is clear that an attempt to open Steno's duct together with the removal of the stone which is impacted in the upper portion of the duct would not give him permanent relief and would, therefore, be useless. The lack of drainage through Steno's duct has resulted in so many infections and so much irritation that the patient fears the development of a malignant growth.

It seems, consequently, wise to remove the entire gland together with the stone which is impacted about its center. The dangers of the operation are confined to injury of the branches of the facial nerve, whose course is indicated in Fig. 319. The close proximity of the nerve and artery makes it difficult to clamp and ligate the latter without traumatizing the nerve.

In order to accomplish the removal with the slightest likelihood of injury to the nerves it is wise to expose the entire outer surface of the gland by reflecting a flap of skin as indicated in Fig. 320, 1. Another incision can be substituted for this, as indicated in Fig. 321, 1. The greater portion of this incision is in the line of the angle of the jaw, so that it does not disfigure the patient to any marked extent, but it is difficult to expose the gland in a satisfactory manner through this incision, and consequently we will choose the incision illustrated in Fig. 320, 1, which permits one to make an absolutely complete exposition of the entire gland and the vessels and nerves.

The flap is turned back, as indicated in Fig. 320, 2, exposing the facial nerve together with the blood-vessels, and exposing the artery and vein and branches of the facial nerve which extend in a fan-shaped direction underneath the gland. This illustrates how difficult it would be to control hemorrhage without injuring the nerve in case one failed to take the precaution of carefully isolating the blood-vessels and clamping and ligating these before attempting to remove the gland itself. During the subsequent steps of the operation it is wise to leave the angle of the mouth exposed and to lightly pinch the tissues with a dissecting forceps before cutting them, because if the tissue about to be severed contains a branch of the facial nerve it will be possible to see the contraction of the muscles at the angle of the mouth, and in case of these contractions the nerve must be

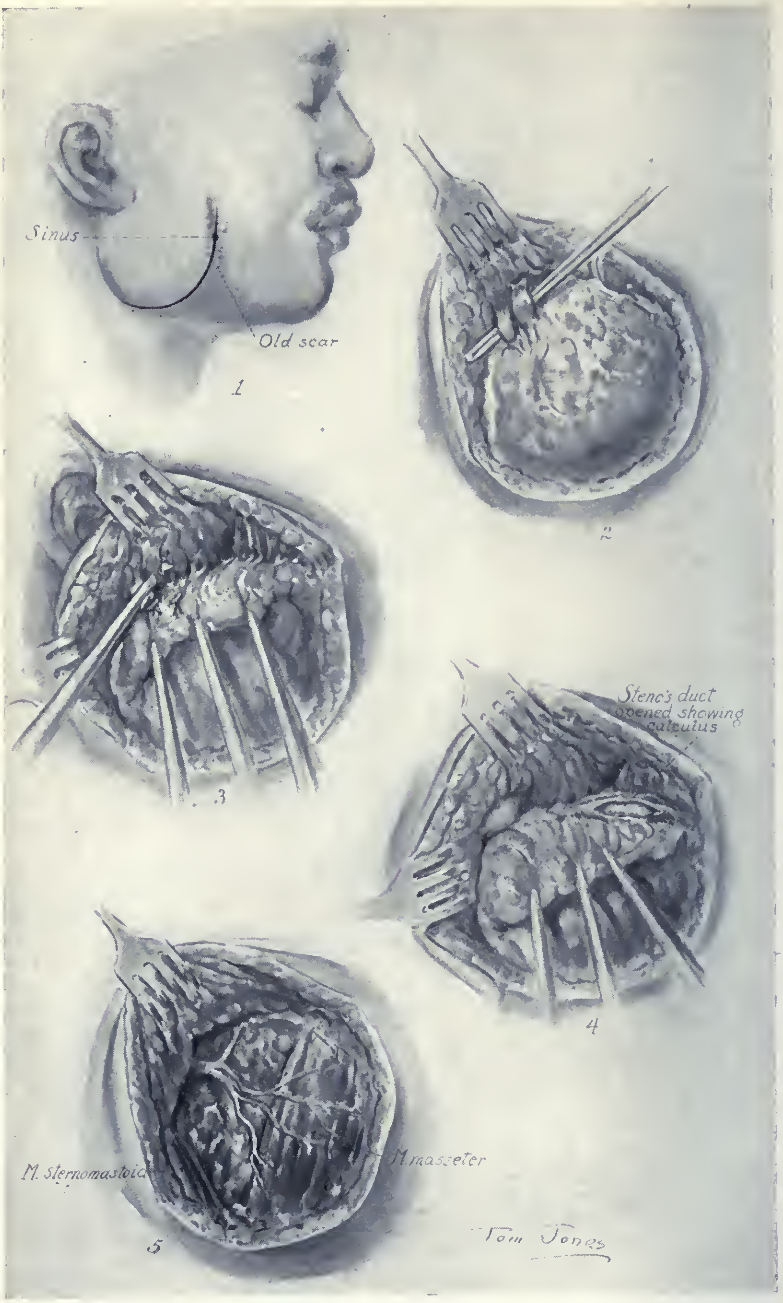

Sinus
Old scar
1
2
3
Steno's duct opened showing calculus
4
M. Sternomastoid
M. masseter
5
Tom Jones

Fig. 320.

dissected out of the tissues to be cut in order to prevent paralysis of the muscles supplied by the respective nerves. The vessels and nerves have now been laid bare directly in front and a little below the ear, and have been separated so that a forceps can be applied to the vessels without danger of injuring the nerve (Fig. 320, 3). The vessels are cut between forceps and ligated at once in order to remove the forceps from the field of operation, and then the dissection of the gland is carried on step by step from behind forward, being careful at each side to preserve all the nerves. Some of the smaller branches will undoubtedly be cut, but by preserving the larger branches the nerve supply of the face will remain almost normal, so that the deformity will be exceedingly slight except when the patient tries to pucker his lips as in attempting to whistle.

Before proceeding with the removal of the gland we will open Steno's duct directly over the enlargement about its center, making an incision into the gland in the direction of Steno's duct, which corresponds to the direction of the nerves, so that the incision is parallel with the lower jaw, as shown in Fig. 320, 4. This exposes a calculus nearly 2 cm. in length and ½ cm. in diameter. It is surrounded by a quantity of thin pus contained in a cyst-like cavity, the fluid evidently consisting of the infected secretion of the parotid gland. With a fine probe we will try to locate the efferent duct whose function it was to carry this secretion of the gland into the mouth, but it would be quite surprising if we should succeed in finding the lumen of this duct, because it has been occluded for months.

Having failed to find this lumen, we proceed to the excision of the gland, avoiding all the nerve branches which can be seen and as many as possible of the minute branches by first pinching the tissues before cutting them. This leaves a cavity

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Fig. 320.—1, Enlarged parotid gland, showing scar of old incision and very small fistulous opening. Note line of incision. 2, The skin and subcutaneous tissue flap has been dissected upward, exposing to view the temporal artery and vein and the body of the parotid gland. 3, The gland being separated from the masseter muscle after ligation of the temporal vessels. 4, Steno's duct exposed, showing the calculus. 5, View of base of wound after total removal of the parotid gland, showing branches of the facial nerve.

overlying the masseter muscle and the joint of the inferior maxilla free from gland tissue, but still containing the branches of the facial nerve which have been preserved (Fig. 320, 5).

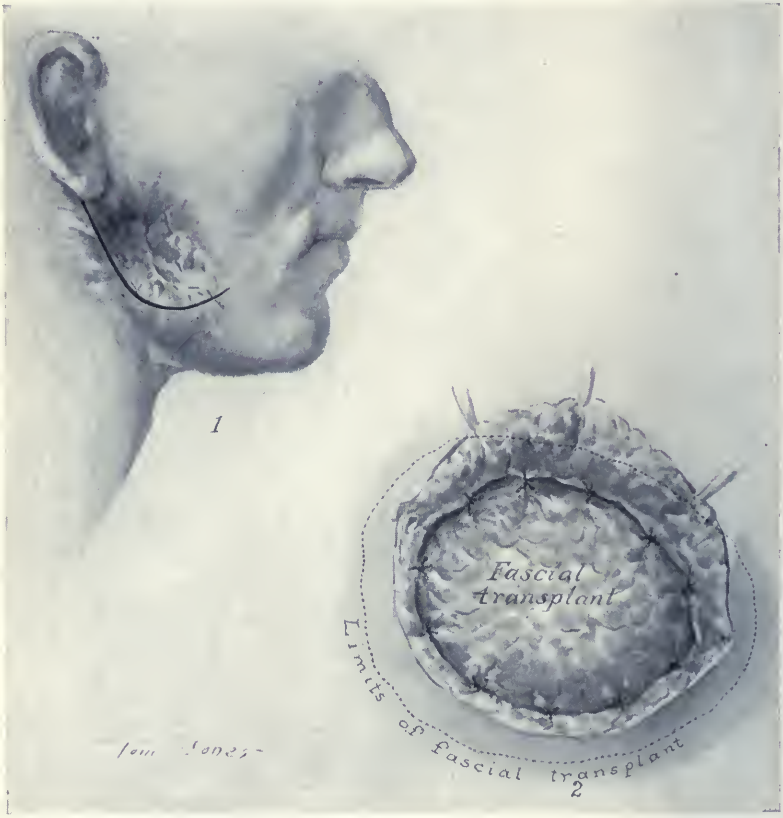

Fig. 321.—1, Depressed scar over region of angle of right mandible. Note line of incision. 2, The flap has been reflected upward and a portion of fascia lata placed in the depression, fat side outward, and sutured to the edges of the wound. The total width of the transplant is shown by a dotted line.

The skin-flap is now placed in position and sutured with the greatest care with horsehair. Only a very small bite is taken on each side and the suture is drawn just sufficiently tight to bring the edges together, care being taken not to produce any stitch marks by tying the sutures tightly. A minute drain is inserted at the lowest angle to prevent the accumulation of serum. This will be removed in twenty-four hours and will permit the edges to come together accurately at this point early. In this manner we can effectually avoid a troublesome scar. Of course, the fact that the cyst containing the stone was infected will make it possible for some infection to take place underneath this flap, although we were exceedingly careful in trying to prevent any of the fluid from touching the wound. As a result of this operation the patient undoubtedly will be free from a recurrence of his trouble. The deformity from the scar will be minimum and there will be practically no deformity from paralysis due to section of the nerves passing through and behind the parotid gland.

CASE II.—The second patient is a male aged thirty-one. Five years ago he received a gunshot wound, the bullet entering the left cheek 2 cm. behind the angle of the mouth. The point of exit of the bullet was 2 cm. in front of and below the right ear. The angle of the right inferior maxilla was torn to pieces. The wound discharged for one month, some sequestra coming out, and then it healed up spontaneously. He has had no pain and the injured region is not painful on pressure. He is able to masticate well. His general health is good.

This case is almost the exact opposite of the patient upon whom we have just operated. At the point at which the former had an enlargement this patient has a marked depression due to the absence of his entire parotid gland together with the angle of the jaw, including the articular portion. The bullet which entered his left cheek passed out through the region of his right parotid gland and carried with it the entire angle of the jaw and the entire parotid gland, leaving a marked deformity because of the depression due to the absence of these structures. He has retained a sufficient amount of the masseter muscle and also the entire lower jaw in front of the angle, together with the teeth contained in the remaining portion of the jaw, so that he has little difficulty in masticating his food.

The articular portion of the jaw being absent, it would be quite useless to insert a bone-graft, as this would undoubtedly fail to improve the function of his lower jaw, although it might possibly be improved cosmetically. The object to be accomplished then must consist in removing the deformity and the question of the method to be employed lies between the grafting of a piece of bone taken from the tibia or from one of the ribs, the grafting of fat and fascia, or the introduction of paraffin. The use of bone is hardly indicated because it is more difficult to accomplish a satisfactory result where it does not touch the jaw bone at each end than the introduction of other tissues, and it would be difficult to make a smooth correction of the deformity with bone. The use of paraffin is not very satisfactory because of the fact that the region is not at rest and the paraffin would be likely to cause more or less irritation. The introduction of fat and fascia, on the other hand, seems to be the most satisfactory because we can arrange the size of the graft in accordance with the necessity, and arrange its form so that the cavity will be filled to a slightly greater extent than is necessary to overcome the deformity because there will be later a slight amount of loss of tissue, and by overcorrecting the deformity at the time of operation one can produce almost a perfect correction.

In this case the incision to be chosen is shown in Fig. 321, 1, because here it is not necessary to make an accurate dissection. All that is required is an exposure of a sufficient amount of space to enable us to fill in enough tissue to correct the deformity. We consequently cut a flap a little larger than the extent of the depression and fold it back. We next search for a portion of the body in which there is an abundance of fat and dissect out a flap about one-fourth larger than the flap in the patient's cheek in order to provide for shrinkage of the flap to be excised. We dissect up the flap slightly larger and thicker than would be sufficient to fill in the depressed area and of as nearly the same form as we can, and transfer this immediately to the space laid bare by the incision. The flap is then carefully sutured with very fine chromicized catgut suture into the depressed space and a sufficient number of interrupted sutures are used to hold it securely in place, as shown in Fig. 321, 2. Then the skin-flap is carried over and the transplanted flap of fat and fascia sutured in place with the same care and accuracy as was practised in the previous case. There is no likelihood of infection in this case because the greatest possible precaution has been taken in every step of the operation. Consequently, it will not be necessary to provide for drainage, although it happens occasionally that some of the fat in the transplanted flap will be liquefied before it has grown into its new place, and this liquefied fat will seek the lowest portion of the cavity and will have to be evacuated by the separation of one of the stitches.

Now that the operation has been completed we have a slight enlargement directly over the area that was occupied by the depression, but this we believe is only sufficient to provide for the natural shrinkage which always occurs after correcting such deformities.

Case III.—The third patient is a man of twenty-seven years who complains of a swelling of the left side of the neck of eight months' duration.

Examination.—The left parotid gland is the site of an irregular hard tumor mass occupying the posterior portion of the gland anterior to the ear and roughly the size of a small egg. The posterior chain of cervical lymph-glands on the left side is enlarged, discrete, not tender, and freely movable as a continuous chain as far down as the level of the clavicle. The largest gland measures 2 x 3 cm. in its opposite dimensions.

This patient comes with a swelling in the region of the parotid gland about 2 cm. in thickness and covering the entire lower half of the gland. There is secondary swelling along the anterior edge of the sternocleidomastoid muscle. There is a history of tonsillar infection and a secondary infection of the middle ear. There is no fluctuation perceptible over any of the swellings. The development of the swelling has been so slow that it seems likely that we have to deal with a tuberculous process involving the lower portion of the parotid gland and the cervical lymph-nodes.

The treatment must consist in the removal of all these diseased tissues together with the removal of the infected tonsils. These tissues can be approached most effectually through an incision extending from the mastoid process along the anterior border of the sternocleidomastoid muscle (Fig. 322, 1). In order to secure a permanent result we must, of course, remove all these glands so that there will be none of the tuberculous material left to cause recurrence. On removing these glands it is important to avoid injuring the branch of the facial nerve which we preserved in the first one of these three cases. Lower down it is important to preserve the branches of the spinal accessory

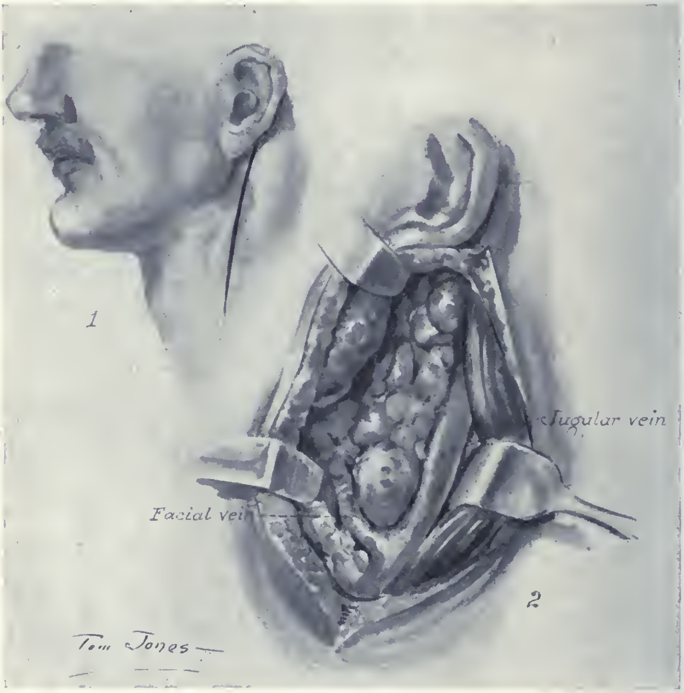

Fig. 322.—1, Enlarged lower pole of parotid gland and several enlarged cervical lymph-glands. Note line of incision along anterior border of left sternocleidomastoid muscle. 2, Dissection showing the parotid and cervical glands enlarged. Note the large gland just at the junction of the facial with the jugular vein.

nerve which usually cross some of the enlarged lymph-nodes. It is important to dissect out one lymph-node with special care, which is almost always located at the bifurcation of the facial vein with the deep jugular vein (Fig. 322, 2). If possible, the lymph-nodes should not be crushed or opened in order not to disseminate any of the tuberculous material contained in them. Nearly thirty years ago Dr. Christian Fenger pointed out the importance of making an absolutely clean dissection of the neck in these cases in order to remove not only the glands which were markedly infected but also the smaller glands which have but a slight amount of infection. At that time the results from these operations were not satisfactory because the two most important elements in the treatment had not been introduced, namely, the removal of the focus of infection in the tonsils or adenoids, and the dietetic and hygienic after-treatment. A large proportion of patients who were treated quite as thoroughly as we treat these patients at the present time died within a few years of pulmonary tuberculosis. They had been but slightly benefited by the removal of the infected glands. Later on it was found that a large proportion of these patients would recover fully and permanently if the tissues primarily infected, namely, the tonsils and adenoids, were removed, and the patient were placed under the best possible hygienic surroundings and given the best kind of nourishing food. Some cases received treatment of tuberculin injections or had the neck exposed to x-ray treatments. In our experience a very large number of patients treated by this plan have recovered fully and permanently, but this is the case only when the infection has not destroyed the tissues of the lymph-nodes or the tissues of the parotid gland, which is the case in the patient before us. However, even if these glands have been destroyed to a greater or less extent, these patients will frequently make a permanent recovery without removal of the glands if the infected glands are laid open, cureted, and treated with iodin or bismuth paste, but the deformity resulting from this operation is much more objectionable than the deformity from the incision which we are making, because this is largely hidden by the line of the anterior edge of the sternocleidomastoid muscle.

We have now exposed the infected portion of the parotid gland and the infected lymph-nodes in their relation to the anatomic structures in the neck. We will carefully continue the dissection, removing the entire lower half of the parotid gland, which contains caseous material, and all the enlarged lymph-nodes. The upper ones have all undergone caseous degeneration. The lower ones, which have been infected more recently, do not show this change.

After removing all these structures we cover the entire surface with 5 per cent. compound tincture of iodin, because we have a superstition in favor of this remedy. Others use iodoform, and still others no antiseptic whatever, and the results seem to be equally good, but having had most satisfactory results in cases in which we have applied tincture of iodin, we continue to use this remedy and feel justified because it seems perfectly proper to make use of any method of which we are certain that it is entirely harmless, even though it may be practically useless at the same time. Were there any doubt concerning the former quality of the remedy in these cases, we should, of course, follow the practice of those that use no antiseptic whatever after removal of these glands. The use of iodoform is probably equally harmless, but it is extremely objectionable because of its disagreeable odor.

In closing the wound whenever the infected glands have not been opened or there has been no soiling, we close the entire wound. Whenever there has been soiling, we pack a piece of gauze lightly into the wound and permit it to protrude through a little buttonhole behind the lower edge of the wound. This gauze is removed on the second day after operation. The wound is then closed by applying some particularly fine catgut sutures about 2 inches apart throughout the line of incision in order that the tension may be taken off entirely from the skin sutures which are applied in the manner practised in the first and second cases.

CLINIC OF DR. DANIEL N. EISENDRATH

COOK COUNTY AND MICHAEL REESE HOSPITALS[1]

METHODS OF EXAMINATION IN THE DIAGNOSIS OF ABDOMINAL TUMORS

Summary: A general review of the information to be gained by physical examination in the presence of abdominal tumors; importance of the clinical history; inspection; points to be noted; palpation; importance of percussion in the examination of hollow viscera; auscultation; special methods.

I DESIRE to present during the present course cases illustrating many varieties of abdominal tumors, employing the latter term in its broader sense of a swelling, no matter what its origin may be, because it is very difficult at times to exclude the possibility of an inflammatory origin in a given swelling. One of the patients whom I will show had a primary carcinoma of the cecum, complicated by abscess formation which led some of us before operation to feel certain on account of the rise in temperature, apparently acute onset, and high blood count that we were dealing with a purely inflammatory tumor having its origin in the appendix, while in the opinion of others a neoplasm alone was present. I need hardly recall in this connection the observation which no doubt is familiar to you, namely, that it is almost impossible in certain cases, without a microscopic examination, to differentiate the hyperplastic form of tuberculosis of the cecum from a carcinoma. It is of interest in this connection to note that W. J. Mayo found carcinoma was present in 31 per cent. of the cases of diverticulitis of the sigmoid. In order to justify my retention of the term "tumor" let me direct your attention to the fact that tertiary syphilis of the various abdominal viscera, especially of the stomach, will greatly simulate a malignant condition. Again, how often do we find that the torsion of a tumor with a long pedicle, such as an ovarian cyst, gives rise to purely inflammatory symptoms, the underlying cause being discovered only at operation.

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[1] The cases cited in this series of clinics on abdominal tumors were presented in clinics at both the Cook County and the Michael Reese Hospitals. Only the diagnosis in general is taken up in the present clinic, the special diagnosis of the tumors of individual structures being reserved for future clinics.

I could cite numerous analogous examples of the puzzling clinical pictures which one encounters in this field, but will reserve a more detailed reference until I present some typical cases of each class in future clinics. Let me impress upon you at this time, however, the necessity of most thorough investigation of every patient who has an abdominal tumor (in the sense I have employed the term) if you would avoid the many pitfalls which lie in the path of those who do not employ every modern diagnostic aid in their daily work.

The data upon which we base our diagnosis of an abdominal tumor are the following:

1. A careful clinical history.
2. The physical examination.
3. Special methods of diagnosis.

The special methods of diagnosis, such as radiography, pyelography, ureteral catheterism, gastric analysis, blood examination, etc., have not only greatly simplified our problem, but have enabled the surgeon to make a diagnosis at a much earlier period than was formerly the case.

To depend upon a physical examination alone without calling to our aid these newer methods of diagnosis is a step backward. Therefore it is of the utmost importance to be familiar with these methods. The surgeon who gives his patient the benefit of every possible resource at his disposal will, by a skilful combination of the various data, make a diagnosis in the majority of cases.

1. **Value of Accurate Clinical History.**—The value of the history of the mode of development of an abdominal tumor cannot be too strongly emphasized. The age of the individual, his family and venereal history, the possible relation of any

previous illnesses to the present one, the history of an accident or of previous operations, whether he has lived in a tropical country, and a gain or loss in weight are of the first importance. In some cases there are definite symptoms pointing to some lesion of the alimentary canal, such as colicky pain, vomiting, constipation, abdominal distention or bloody vomitus, or stools. At times there is a history of persistent or recurrent hematuria or pyuria accompanied by bladder symptoms to aid one in suspecting some lesion of the urinary tract. The sudden or gradual onset of jaundice with or without acholic stools is of great value in localizing the seat of a tumor. At times you will obtain the history of having noticed a circumscribed or a more generalized enlargement of the abdomen accompanied by symptoms pointing to a definite structure. It must not be forgotten that more than one tumor may be found, and again, that an abdominal tumor is often only a metastasis of a malignant condition in some other portion of the body and vice versa (see Fig. 328, *D*). A metastatic tumor which has first attracted our attention may be extra-abdominal and yet the primary seat be in one of the abdominal viscera. This last named condition is not infrequently found in cases of certain tumors of the kidney like hypernephroma, where the bony metastases (see Fig. 328, *D*) overshadow in the clinical picture the primary enlargement. A pneumococcus or tuberculous peritonitis may form an encapsulated collection of fluid (see Fig. 329, *F*) and the diagnosis be exceptionally difficult unless one has obtained a history of an acute onset. Actinomycosis or tuberculosis of the cecum may give rise to a tumor in the right iliac region of such form and consistency as to render the differentiation from carcinoma almost impossible unless microscopic examination is made. In the case of tumors arising from the pelvis it is very important to consider not only the age of the patient but also all deviations from the normal menstrual history, and finally a history must also include the possibility of syphilis being the cause of the abdominal condition.

The age of the patient has some influence, cancer being predominantly a disease of middle age or beyond, while sarcoma is more frequently present in young persons. In the case of tumors

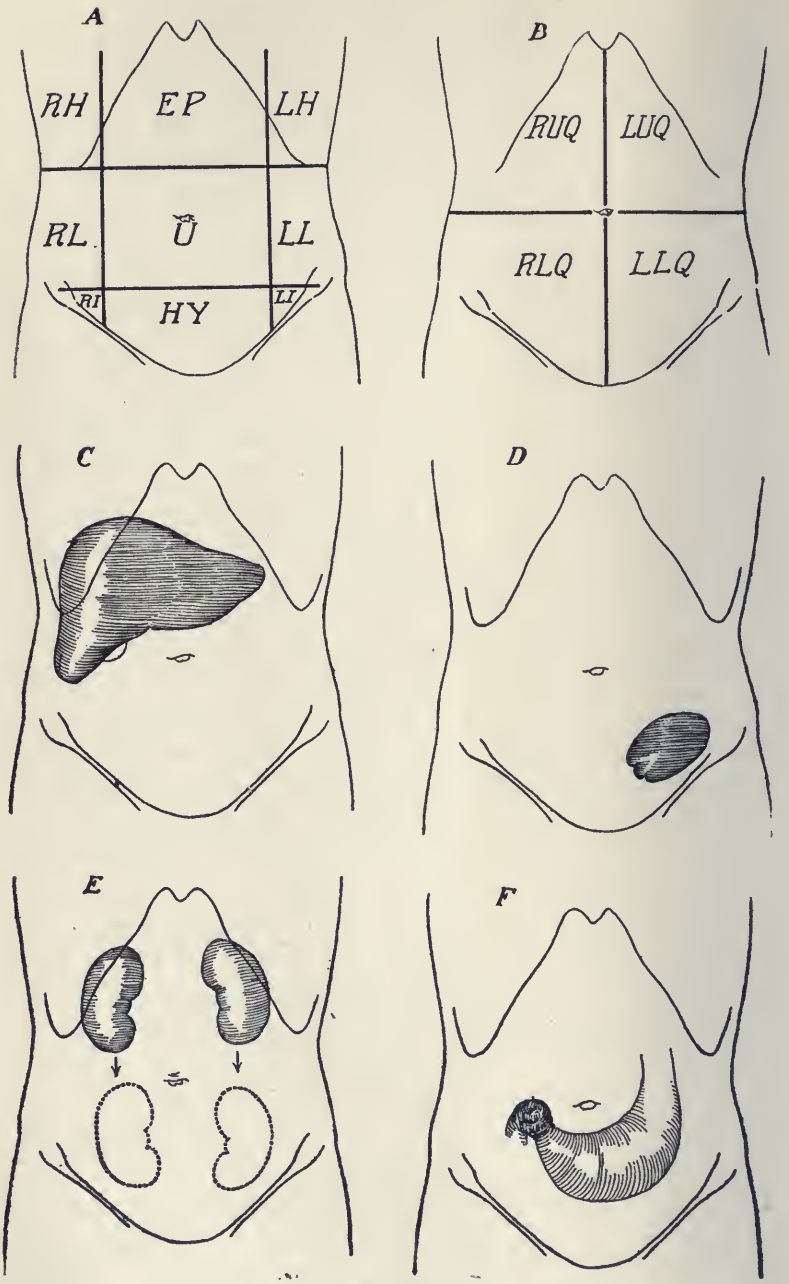

Fig. 323.

with long pedicles it is of importance to obtain a history as to any possible change in position which has been noted by the patient, or any symptoms accompanying such a change in position.

In attempting to make a diagnosis of an abdominal tumor you must not omit a thorough general examination. For example, a splenic tumor may be simply a local expression of leukemia, or an enlarged liver can be the seat of multiple metastases following a carcinoma of the breast, operated years before.

The history of a sudden appearance and disappearance of tumors is of importance. This is found in the so-called hysteric tumors, in tumors due to impaction of feces, and in some cases of pancreatic and ovarian cysts.

I could mention innumerable combinations of symptoms which one encounters in daily practice, but, as I stated before, the diagnosis of an abdominal tumor is made by a careful analysis of the data obtained by many methods, an important factor being a careful clinical history.

2. **Physical Examination of the Abdomen.**—1. *Inspection:* (*a*) *Location of Tumor.*—There are two principal methods of dividing the abdomen for purposes of physical examination in order to describe the location of a tumor. In one of these (Fig. 323, *A*) we choose certain more or less fixed anatomic points and divide the surface into nine regions, with which every student

Fig. 323.—*A*, Divisions of abdomen into its nine regions. *RH* and *LH*, Right and left hypochondriac regions. *RL* and *LL*, Right and left iliac regions. *EP*, Epigastric region. *U*, Umbilical region. *HY*, Hypogastric region.

B, Division of abdomen into quadrants. *RUQ* and *LUQ*, Right and left upper quadrants. *RLQ* and *LLQ*, Right and left lower quadrants.

C, Location of liver in hepatoptosis. Lower border often at level of umbilicus, so enlargements of gall-bladder or tumors on anterior surface or inferior border may be found in right iliac region.

D, Movable spleen lying in left iliac fossa. Note the characteristic notches along anterior edge of spleen.

E, Abnormal mobility of the kidneys. Note difference in position of normally located and of movable kidneys (dotted outline).

F, Carcinoma of pyloric end of stomach in a case of low position of the viscus (gastroptosis). Note position of greater curvature below transverse line through anterior superior spines, tumor palpable below level of and to right of umbilicus.

of anatomy is familiar. In the second method the umbilicus is chosen as the fixed point, the resulting division (Fig. 323, *B*) being into quadrants. The latter method is being employed more and more every year, and yet the nine-region division has been so thoroughly drilled into us in our early medical school years that

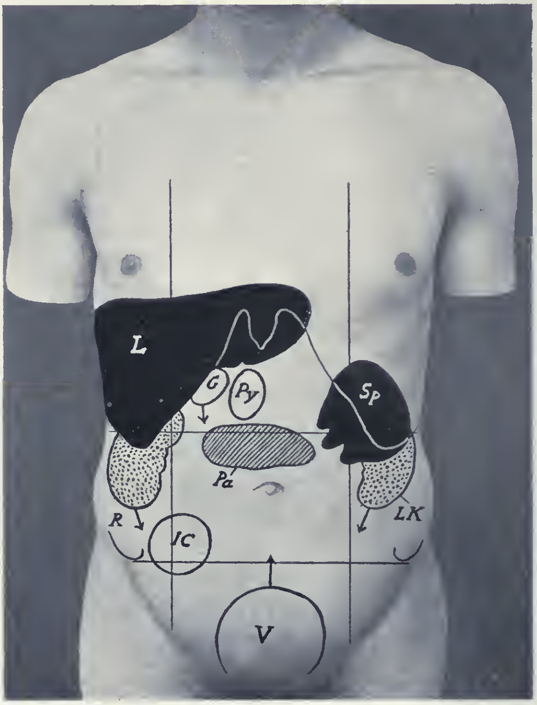

Fig. 324.—Tumors of the abdominal viscera. The black arrows indicate the directions in which they grow: *L*, Liver; *G*, gall-bladder; *Py*, pylorus; *Pa*, pancreas; *R*, right kidney; *LK*, left kidney; *Sp*, spleen; *IC*, ileocecal tumors; *V*, tumors due to distended bladder, ovarian cysts growing upward, fibroids of uterus, etc. (Eisendrath, "Surgical Diagnosis.")

it is difficult to abandon it for the more simple division into quadrants. Whether the one method or the other is used, it is necessary to be familiar at least with the viscera which normally lie beneath the surface of the various regions. A glance at Fig. 324 will recall the usual locations of these viscera and show why tumors arising from them are most frequently found at the place where the viscus normally lies. It would greatly simplify matters, however, if we were certain that a given viscus could always be found in its normal location. Unfortunately, this is not the case, hence you must be familiar with the fact that there are all possible variations from the normal position of the abdominal viscera. This deviation is due to a number of causes, such as (*a*) elongation of structures which act as supports, thus permitting of a wide range of mobility; (*b*) congenital anomalies, so that the viscus develops at an abnormal location or there is a complete transposition of both thoracic and abdominal viscera. Examples of the first group in which an elongated support permits a viscus to be found in an abnormal location is not infrequently observed clinically in the case of solid viscera like the liver (Fig. 323, *C*), the spleen (Fig. 323, *D*) and the kidneys (Fig. 323, *E*) as well as in the hollow viscera such as the stomach (Fig. 323, *F*) and the various portions of the large bowel (Fig. 325, *A*, *B*, *C*). As examples of the second group in which the abnormal location is the result of a congenital anomaly I might mention the dystopic kidney, the viscus being located either in one of the iliac fossa or even in the true (bony) pelvis (Fig. 325, *D*). Other instances of malposition as the result of developmental disturbances are the presence of an undescended testis within the abdomen (abdominal form of non-descent) or a faulty rotation of the cecum, so that it lies just beneath the liver. One of the most interesting and, fortunately for the diagnostician, rather rare conditions is a complete transposition of both thoracic and abdominal viscera, those which normally lie upon the right half of the abdomen being found in the left half, and vice versa (Fig. 325, *E*). You must never forget that an enormously distended urinary bladder may cause a median enlargement just above the pubes (Fig. 325, *F*). At first sight it would seem superfluous to mention this, but I was once called in consultation to see a case of suspected encapsulated peritonitis in which the introduction of a catheter soon showed that the attending physician had not thought of such a simple condition as a distended bladder.

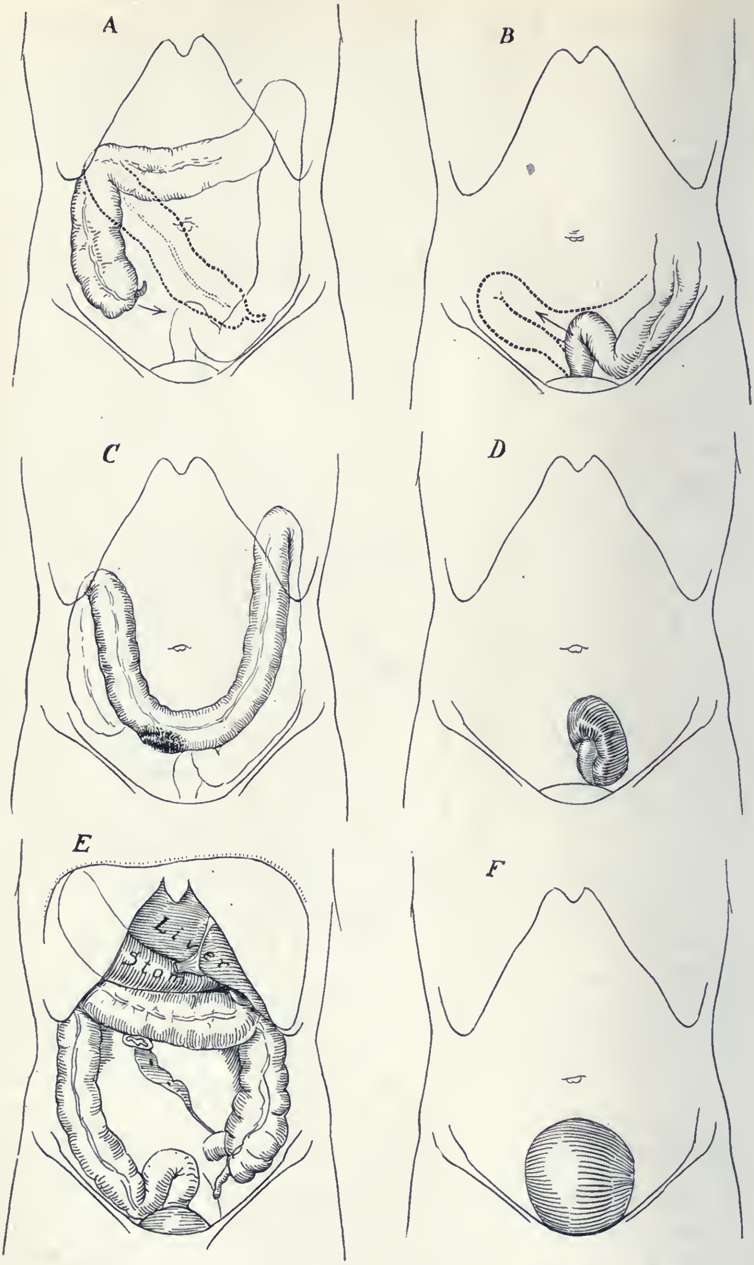

Fig. 325.

(*b*) *Changes in Contour of the Abdomen Either General or Localized.*—A collection of fluid within the abdomen can, as you know, either be generalized or encapsulated. In the former case there is a general widening of the abdomen, especially in the flanks and the lower portion of the abdomen. This condition is called ascites, of whatever origin it may be. In the case of encapsulated fluid there is only a localized change in contour. Ovarian cysts and uterine tumors, in fact, any tumor arising from the true pelvis, cause enlargement, lateral or median, in the lower portion of the abdomen. Tumors of the spleen and kidney give rise to a prominence in the corresponding lateral regions. Tumors of the stomach, mesenteric glands, omentum, or pancreatic cysts cause a central enlargement. The lateral bulging or prominence is not infrequently due to an aneurysm of the abdominal aorta or a very vascular sarcoma arising from the retroperitoneal tissues. You will understand the reason for these various changes in contour of the abdomen by a study of Figs. 328, *A* to 329, *D* inclusive.

(*c*) *Inspection of the Color of the Skin, etc.*—One of the first things to note is whether there is any change in the color of the patient's skin. The presence of jaundice accompanied by certain abdominal findings is of great aid in the recognition of tumors of the head of the pancreas (Figs. 326, 329, *E*, and 330), or of an enlarged liver (Fig. 329, *E*), or of some form of obstruction

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Fig. 325.—*A*, Abnormal mobility of the cecum. The cecum in these cases may lie close to or even beyond (to left of) the median line or next to the bladder in the true (bony) pelvis.

B, Abnormal mobility of the sigmoid. If the mesosigmoid is very long the sigmoid is found to right of the median line.

C, Tumor (carcinoma) in an unusually long and movable transverse colon. Radiography has shown that this portion of the colon lies even under normal conditions much lower than formerly thought.

D, Position of kidney in a case of congenital dystopia. Note location of the kidney in the true (bony) pelvis. The renal pelvis and ureter is usually directed forward.

E, Transposition of viscera. Note position of liver in left upper quadrant and of cecum in left lower quadrant.

F, Prominence in median line in suprapubic region due to greatly distended bladder.

of the common duct of a non-malignant nature, such as calculus or stricture.

Inspection of the abdomen as to the presence or absence of dilatation of the superficial veins is of importance. If the veins in the central portion of the abdomen are dilated it points to some obstruction in the circulation, whereas if the veins on the lateral aspects of the abdomen or thigh are dilated (Fig. 327) there is some obstruction to the return circulation in the vena cava.

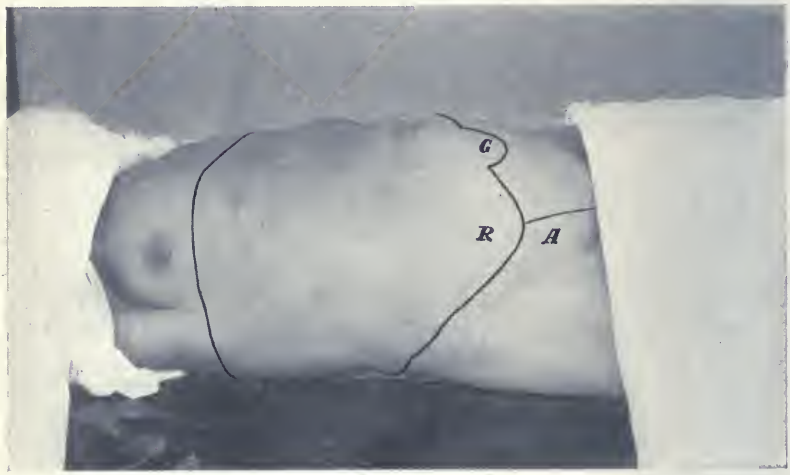

Fig. 326.—Side view of case of carcinoma of the head of the pancreas. (Eisendrath, "Surgical Diagnosis.") Yellow tint of flesh due to obstruction of common duct, as it passes through head of pancreas to reach the duodenum. *G*, Enormously distended gall-bladder which could be distinctly felt through the abdominal wall. Its contents were cystic on account of the long-standing obstruction of the common duct. *R*, Lower border of right lobe of liver, which is enormously enlarged on account of secondary deposits. The upper level of liver dulness is shown just below the level of the nipple. *A*, Area of dulness due to free fluid in peritoneal cavity due to pressure upon portal vein.

Inspection must also include the presence or absence of the testis, as there is always a possibility of a pelvic tumor arising from a retained abdominal testis.

(*d*) *Visible Peristalsis or Pulsation.*—Never omit a glance at the abdomen to see whether peristaltic waves are present, as this is of great importance in the diagnosis of certain tumors like those of the pylorus with a corresponding obstruction of the intestinal lumen. Again, certain tumors, either aneurysms or very vascular enlargements, show visible pulsation which is of importance in making up the data upon which a diagnosis is based. You must not forget, however, that a tumor which lies in close relation to some of the large blood-vessels of the abdomen may show transmitted pulsation. Expansile pulsation speaks for an aneurysm; lifting pulsation, for a tumor attached to or in close relation to a blood-vessel, but a very vascular sarcoma may cause a pulsation simulating greatly that of an aneurysm.

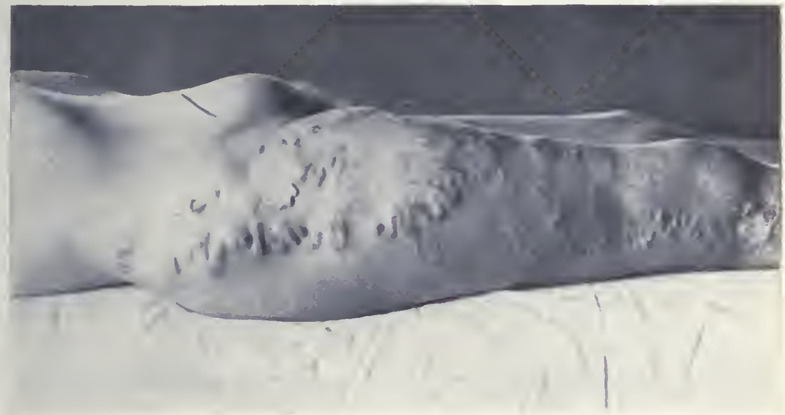

Fig. 327.—Lateral view of tumor of abdomen due to aneurysm of the external iliac artery causing prominence in right iliac region. (Eisendrath, "Surgical Diagnosis.") Note the extensive varicose veins along the outer aspect of the thigh.

2. *Abdominal Palpation.*—Palpation helps in the differentiation of tumors of the abdominal wall from those within the abdomen. In the latter the tumor becomes less prominent when the patient is asked to sit up, whereas in the former it becomes more prominent. Certain methods of palpation are considered more or less standard. The best position for the patient is the dorsal one, with the shoulders slightly raised and the thighs flexed (Fig. 331). You must never neglect to have warm hands and to lay them flat upon the abdomen, making

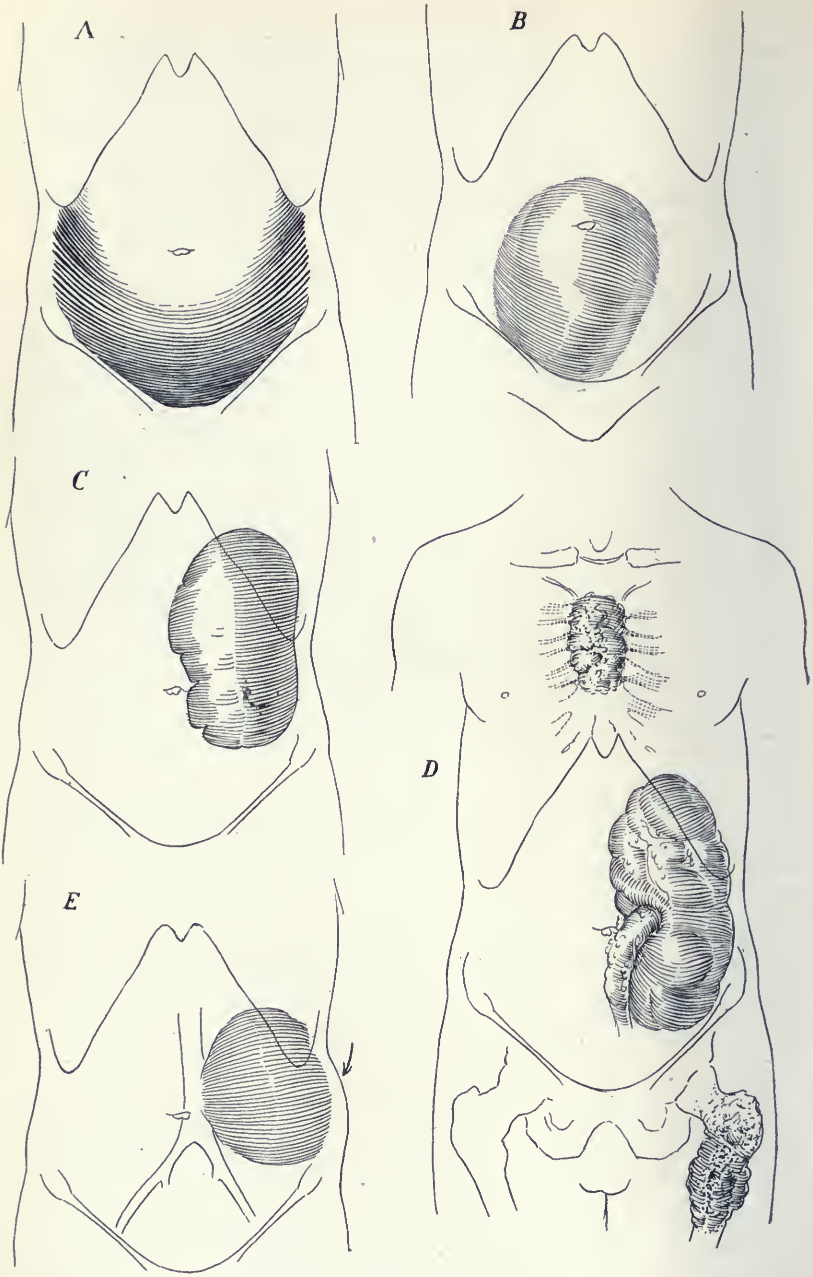

Fig. 328.

pressure gradually. For tumors which lie beneath the costal arch the hand is inserted deeper and deeper with each inspiration. For renal tumors bimanual palpation (Fig. 332) is a most excellent method. The value of rectal and bimanual vaginal examination cannot be too strongly urged. In some cases it will be impossible to palpate the abdomen until some of the free fluid has been removed by tapping.

Mobility.—Tumors may be immovable, *i. e.*, fixed. This is the case when they are adherent to the bones, such as the spine, pelvis or ribs, or to the retroperitoneal tissues. A tumor may, on the other hand, possess either passive or respiratory mobility. The latter is usually present in tumors of the stomach, transverse colon, liver, gall-bladder, and kidneys, that is, in all upper abdominal tumors unless they are fixed by adhesions. Inflammatory tumors have little if any mobility, either passive or respiratory, no matter what organ or structure they arise from or are in proximity to. Tumors of the abdominal wall do not show any respiratory or passive mobility. At times it is possible to determine the origin of a tumor, for example, a greatly distended gall-bladder, by its relation to an organ which possesses respiratory mobility (Fig. 330).

Passive Mobility.—Tumors of a normally placed spleen or kidney have but slight passive mobility, whereas those of a movable spleen or kidney may have a very extensive range of mobility. Retroperitoneal tumors (Fig. 335, *B*) and encapsulated intraperitoneal exudates have but little passive mobility. At

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Fig. 328.—*A*, Areas of prominence and of dulness in ascites. Note dulness in flanks and above pubes and tympany in center of abdomen (compare with Fig. 328, *B*).

B, Areas of prominence and dulness in ovarian cyst. Note dulness in median portion of abdomen and tympany in flanks.

C, Location of splenic tumor. The enlargement lies chiefly in the left upper quadrant, emerges from beneath left costal arch and has a characteristic notched anterior edge.

D, Primary renal tumor (hypernephroma) with bony metastases in the sternum and femur. The metastases in this variety of kidney tumor may appear before the primary growth is recognized.

E, Bulging on left side of the abdomen due to large aneurysm of the abdominal aorta.

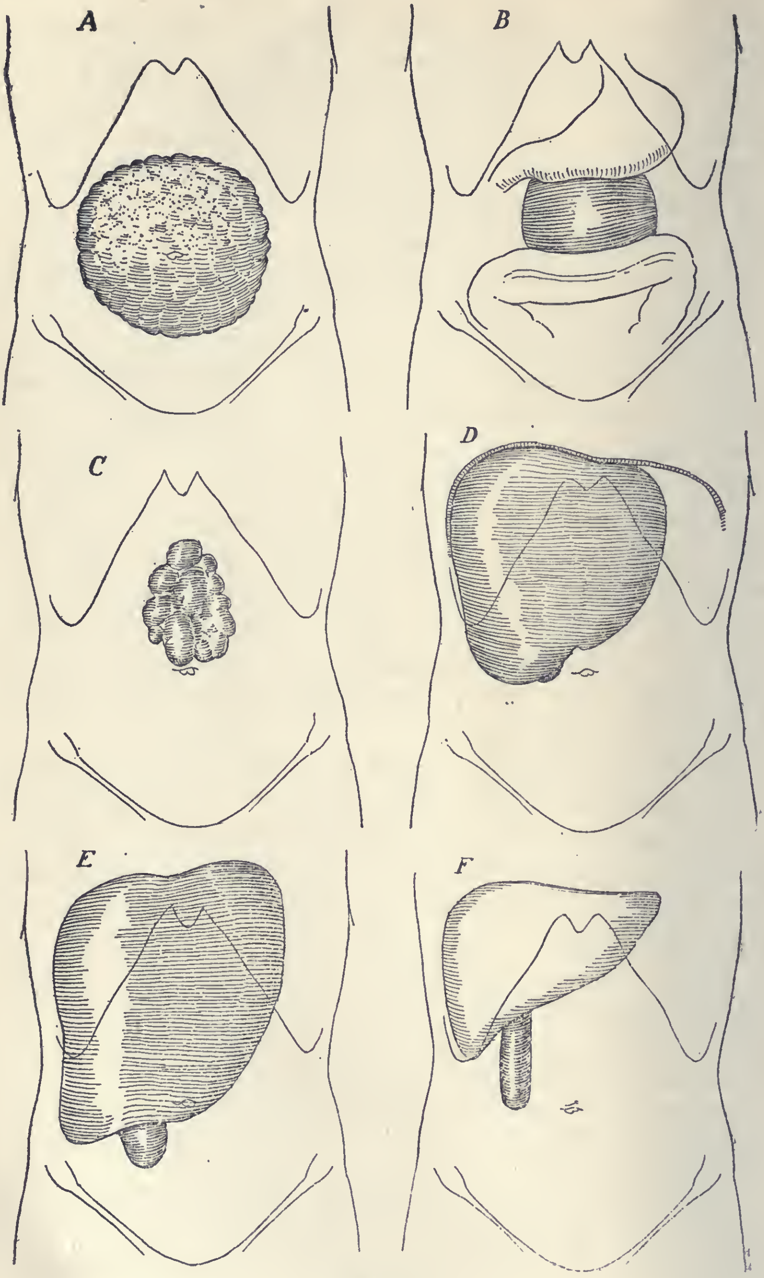

Fig. 329.

times, however, we find cases in which the range of mobility is very extensive. This is true of tumors developing in a movable cecum, transverse colon, or sigmoid (Figs. 325, *A*, *B*, *C*, and 334, *B*). Tumors of the pylorus in certain cases have a wide range of mobility (Fig. 334, *A*). The same is true of tumors of the uterus (fibroids) or ovarian cysts with long pedicles (Fig. 334, *C*), or of mesenteric cysts (Fig. 334, *D*). One is often able to determine that a tumor arises from a certain organ by noting the center of the circle formed by the range of mobility of the tumor.

Other Data Obtained by Palpation.—The presence or absence of fluctuation can be determined by palpation aided by percussion for waves of fluid. The consistency, size, nature of the surface of the tumor and of its edges, and the presence or absence of genuine or transmitted pulsation are all of importance in making a diagnosis. Not infrequently tumors of the spleen retain characteristic notches (Fig. 328, *C*) of the normal spleen until they have attained such a size that it is impossible to recognize the origin of the tumor.

3. *Percussion* is of less importance than palpation except in showing us the relation of a hollow viscus to the tumor and whether free fluid is present or not (Fig. 328, *A*). In free fluid, dulness is always present in the flanks and above the pubes, and changes its location somewhat when the patient is turned on his side. This is not true of encapsulated fluids, which remain constant in position and area of dulness (Fig. 329, *F*). Percussion is of value, especially when aided by inflation of the colon,

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Fig. 329.—*A*, Prominence in central portion of abdomen due to large tumor (sarcoma) of the omentum.

B, Location of pancreatic cysts. Most frequent variety presents between transverse colon and stomach.

C, Tumor mass in epigastric region due to tuberculous glands at root of mesentery (author's case).

D, Area in right upper quadrant of abdomen in which enlargements of liver are usually found.

E, Enormous enlargement of liver and greatly distended gall-bladder in cancer of head of pancreas (compare with Figs. 326 and 329, *F*).

F, Elongated sausage-shaped tumor in right upper quadrant due to hydrops of gall-bladder.

in determining the relation of a retroperitoneal tumor to the bowel. This method of inflation of the colon is of less value today since the introduction of colonoscopy than it was in former years, but not infrequently it is of great value if an *x*-ray examination cannot be made, to inflate the colon and note by percussion that the tumor (Figs. 334, *C* and 334, *E*) lies behind the inflated colon. The only fallacy exists when there are adhesions of the colon to the tumor, so that the colon is displaced inward (Fig. 334, *F*) instead of lying in front of the tumor. The presence or absence especially of free fluid can frequently be noted by tapping on one side of the abdomen while the outstretched hand is held at a point directly opposite, thus eliciting and detecting a wave when fluid is present.

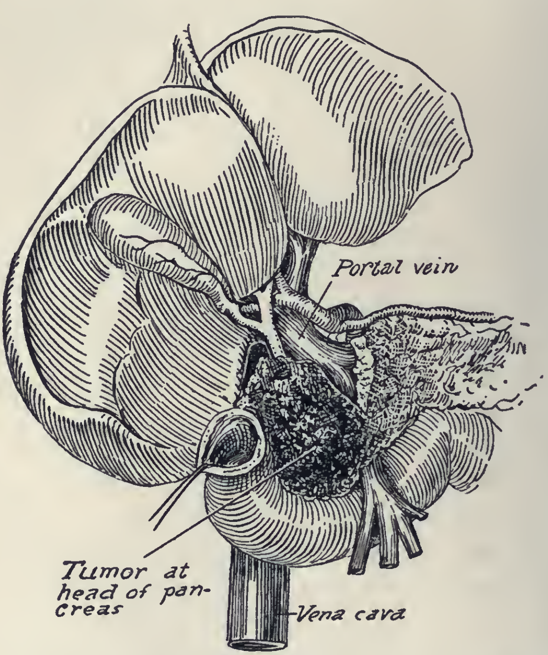

Fig. 330.—Topographic relations of tumor (cancer) of head of pancreas. The tumor causes jaundice (see Fig. 326) and enlargement of the liver and gall-bladder (see Fig. 329, *E*) by pressure on the common bile-duct. The ascites in these cases is due to pressure upon the portal vein.

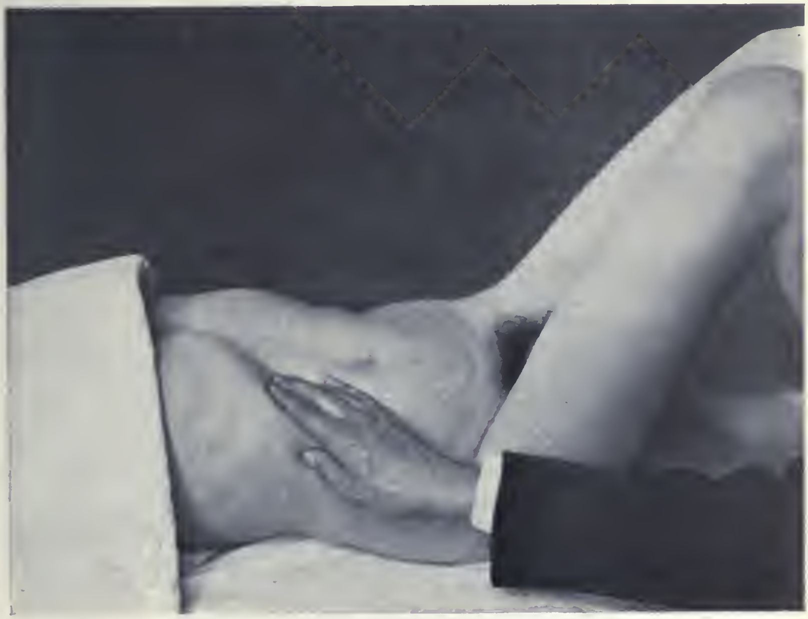

Fig. 331.—Method of palpating the gall-bladder or pylorus. (Eisendrath, "Surgical Diagnosis.") The patient should be laid upon the back with the shoulders slightly raised and thighs flexed upon the abdomen, so that the soles of the feet rest squarely upon the bed. The examiner should approach the patient from the right, laying the hand flat upon the abdomen, and insert it gradually deeper while the patient is instructed to breathe, and thus relax the abdominal wall.

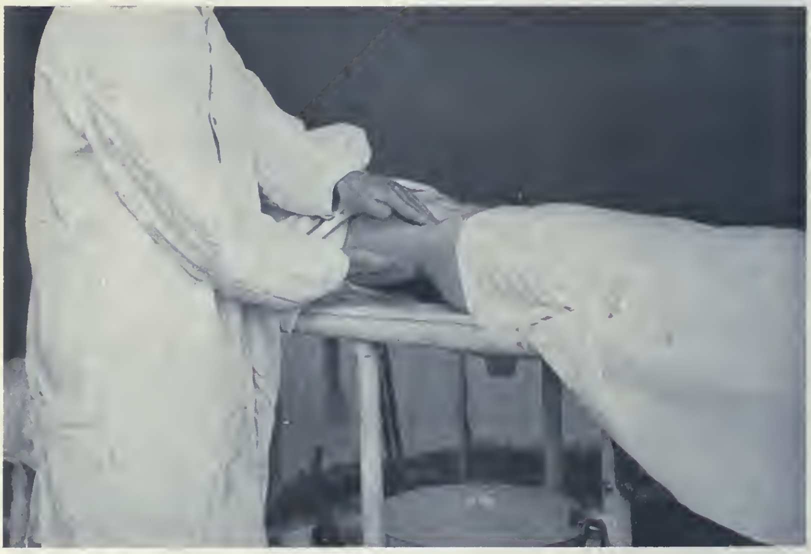

Fig. 332.—Method of examination to determine abnormal mobility or enlargement of the kidney. (Eisendrath, "Surgical Diagnosis.") This method is also used in the determination of the presence or absence of an enlargement of the kidney. The right hand of the examiner, when examining the right kidney, is placed behind the patient in a space between the last rib and the crest of the ilium, so that the parts lying behind the kidney can be raised up to meet the opposite hand, which is pressed down upon it. When examining for a floating kidney the lower pole of the kidney can be felt to slip across the hand lying on the anterior surface of the abdomen.

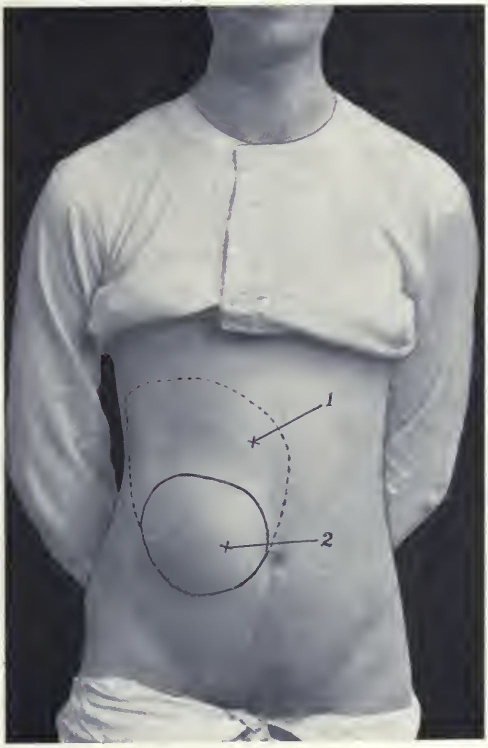

Fig. 333.—The areas of dulness in a case of encapsulated intraperitoneal fluid. (Eisendrath, "Surgical Diagnosis.") 1, Indicates the size of the encapsulated abscess, which was of a tuberculous nature, lying between the abdominal wall and the agglutinated coils of intestines within the peritoneal cavity, extending upward between the right lobe of the liver and the thoracic wall. 2, Indicates the area of external prominence on account of which the case was at first thought to be one of hydronephrosis.

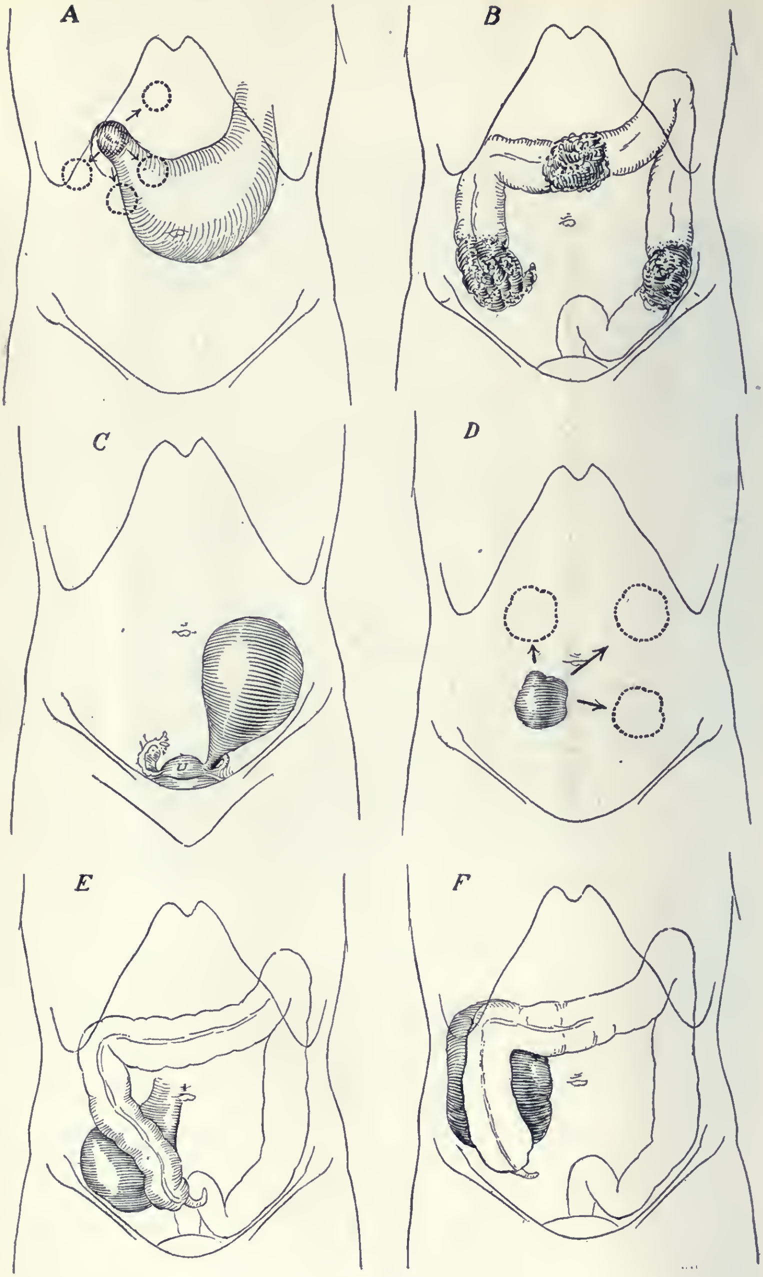

Fig. 334.

Pain is also determined by palpation and may be of some value in the diagnosis. In connection with the presence of fluid let me remind you of the fact that an acutely dilated stomach may give rise to prominence and change in contour of the abdomen, and to fluid waves which resemble the presence of free fluid in the abdomen.

4. *Auscultation.*—This method of examination is of little value except for the determination of fetal heart tones and for the examination of aneurysm and very vascular sarcomata.

5. *Special Methods of Examination.*—This includes examination of the character of the fluids obtained by tapping, *x*-ray examination of the entire alimentary tract, pyelography, examination of the blood, including Wassermann tests, and a number of other methods which I shall refer to again in future clinics in connection with the tumors of the individual viscera.

Let me urge in closing that you familiarize yourself with one of the newer special methods, namely, pyelography, which will often enable you to differentiate whether a tumor arises from the kidney or not, and furthermore, whether it is a retention tumor, such as hydronephrosis of the kidney (Fig. 335, *A*) or a neoplasm. If we obtain a normal pyelogram it shows at once either that the tumor has not invaded the kidney pelvis itself or that it is not in the kidney. I shall speak of this again.

Fig. 334.—*A*, Range of mobility in a case of tumor (carcinoma) of the pylorus.

B, Location of tumors of cecum, transverse colon, and descending colon.

C, Very movable tumor in lower abdomen in a case of pedunculated fibroid of the uterus.

D, Marked range of mobility in a case of mesenteric cyst.

E, Psoas abscess in right iliac fossa displacing cecum inward.

F, Tumor of kidney lying behind inflated ascending colon.

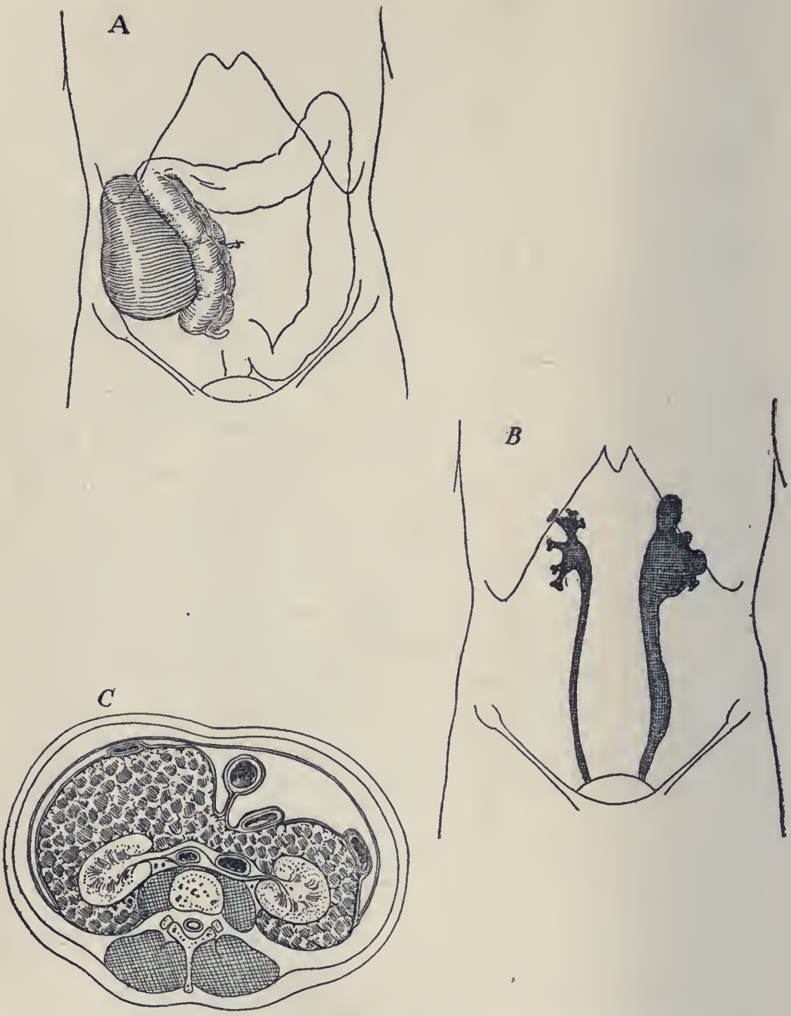

Fig. 335.—*A*, Ascending colon displaced inward after inflation in a case of kidney tumor. This occurs when extensive adhesions are present and illustrates a source of error in the inflation test.

B, Pyelograms of renal pelves. On right side is the pyelogram (obtained by use of thorium) of a normal kidney and on left side of a marked degree of hydronephrosis. This method has become a very important one in the differentiation of abdominal tumors.

C, Cross-section of abdomen showing extent of growth of a case of retroperitoneal lipoma (Reynolds).

CLINIC OF DR. BENJAMIN F. DAVIS

PRESBYTERIAN HOSPITAL

BULLET WOUND OF STOMACH

Summary: A patient who was shot in the back two hours before entering the hospital; diagnosis of penetrating wounds of abdomen; inspection, importance of location of wounds of entrance and exit; the pulse-rate, hemorrhage, abdominal rigidity, pain, tenderness, shock, shifting liver dulness; possibility of more than two wounds of stomach by a single missile; spontaneous healing of gastric wounds; pathology; after-treatment; choice of anesthetic; bad results under spinal anesthesia; prognosis; importance of associated injury of other organs; types of wounds produced by bullets; end-result in present case.

THIS patient is a plumber by occupation, age thirty-two years. About two hours ago he attended an election at a plumbers' union, at which there was considerable bitterness between rival factions. As this man entered the hall somebody began to shoot; our patient attempted a hurried exit, but just as he started to run down the stairway, he felt a terrific blow in the back and it was only by a great effort that he managed to cling to the banister and save himself from falling downstairs. He was given first aid at a nearby emergency station and has just now entered this hospital from a police ambulance.

You note that the patient is pale, his expression drawn and anxious, his body bathed in perspiration; he complains of intense abdominal pain, particularly in the left upper quadrant; you see how he retches at intervals, occasionally vomiting watery material. So far as we know there has been no bloody vomitus. The patient's one complaint is of the pain in the abdomen. Upon examination we find the skin cold and clammy; the pulse is rapid, about 120, but of good quality; the striking thing is the intense rigidity of the abdominal muscles. There is no abdominal distention; on the contrary, the abdomen is retracted considerably, and the powerfully contracting muscles of this young working man give the abdomen a markedly corrugated appearance. There is considerable general abdominal tenderness, most marked in the left upper quadrant. It is impossible to demonstrate shifting dulness; the area of normal liver dulness is not encroached upon. Posteriorly, we find a puncture wound about $\frac{1}{4}$ inch in diameter, which exudes a moderate amount of bright red blood. It is situated on the left side about $1\frac{1}{2}$ inches below and external to the tip of the twelfth rib, in a direct line with the long axis of the rib. There are no other wounds on the surface of the body. The absence of a wound of exit makes it exceedingly difficult to estimate the probable direction of travel of the bullet and we are averse to probing wounds of this type because of the practical certainty of carrying infection into the wound on the probe, and thus converting a relatively aseptic tract into a frankly infected sinus. Moreover, the location of the bullet is of little immediate importance as a rule; it is the possible injury of important organs with which we are immediately concerned, and, from this standpoint, a blind probe is of little value. It is in cases of this type that the *x*-ray may be of great value. In this instance, however, other signs are present which plainly indicate an exploratory operation and we have dispensed with the *x*-ray. A blood count has just been made; there is a leukocytosis of 12,000; the hemoglobin is 85 per cent. (Dare), and the blood-pressure is systolic 110 and diastolic 80. The urine, drawn by catheter, is normal—it contains no blood.

On the basis of the intense abdominal distress and the vomiting it seems certain that the bullet has entered the peritoneal cavity and wounded some abdominal viscus, though it may be that the symptoms are produced by intraperitoneal hemorrhage. The absence of blood from the urine and of macroscopic blood from the vomitus suggests that stomach and kidney may have escaped, although at this time, of course, nothing but exploration can prove it. Not knowing the direction of travel of the bullet we can only state that some organ in the left upper quadrant appears to have been injured.

While the patient is being prepared, I shall discuss the question of penetrating wounds of the abdomen, basing my remarks on experience in civil practice, and also upon the results of some very careful studies on large numbers of patients passing through the hospitals of the War Zone.[1] With all possible care and an extensive experience and a full appreciation of the numerous fallacies, it is frequently difficult to make sure that an abdominal wound is penetrating. If it is difficult when there is an entrance and exit wound, it is still more so when there is only one wound. It may be that shock, hemorrhage, rigidity, or rapid pulse will be present; in some cases which are seen early there will be no such guides. It may be said that the wound of a hollow viscus has in itself no symptoms if it is not extensive enough to produce shock; it is usually hemorrhage or peritonitis which gives the danger signal. As there is a distinct relation between the interval since the receipt of the wound and the mortality, it is important to be able to determine the probability of penetration. Experience has shown that one has to be very careful in making a negative diagnosis, and it has also shown the wisdom of operating in doubtful cases.

Anteroposterior wounds are the easiest to judge. The only point to be remembered is the thickness of the flank muscles. Below the transpyloric plane a wound with the entrance on one side of the midline, and an exit exterior to the lateral body line of the same side, is very often non-penetrating; or it may have just opened the peritoneum. Above the transpyloric plane such a wound, owing to the rounded form of the thorax, is almost certain to be penetrating. The bullet which passes in and out between the semilunar lines probably does not open the abdomen; while the wound that passes in and out outside this line probably does. In a longitudinal direction the bullet which enters near the costal margin and emerges above the groin will most likely traverse the abdomen. Where it is a question of single wounds there is really no guide except the symptoms, as it is usually impossible to tell the direction of the projectile.

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[1] Cuthbert Wallace, A Study of 1200 Cases of Gunshot Wounds of the Abdomen, Brit. Jour. of Surg., 1916–17, vol. iv, p. 679.

Much help is afforded by an x-ray apparatus in such cases. As a rule, such patients look ill, are shocked and cold, but exceptional cases may be of fair color even with cold, clammy extremities and thready or even absent pulse. The pulse is a valuable guide. A rapid pulse, a pulse that does not fall, or a rising pulse is an indication for operation; the rising pulse usually indicates either hemorrhage or peritonitis and sepsis. A pulse-rate of 100 is very common and suggests a good prognosis. A pulse of 120 seems to be the critical rate—of 145 patients with a rate over 120, only 16 recovered. Patients with abdominal injuries nearly always vomit, and the presence of vomiting, therefore, is of little significance with regard to the question of penetration. Hematemesis, of course, suggests injury to the stomach, while the absence of vomiting may be taken as very good evidence that the stomach is not involved. With hemorrhage we have the ordinary clinical signs, but they are not helpful. In order to produce these signs the amount of blood lost must be very great; restlessness, blindness, and air-hunger, therefore, are usually absent; blanching and rapid pulse, while frequently present, cannot be considered indicative of hemorrhage because they are produced by many other causes. Abdominal rigidity is usually present. We must remember in this connection, however, that abdominal rigidity may result from rather superficial wounds, and also is not infrequently seen following spinal injuries. Abdominal tenderness usually is a relatively late sign, indicating peritonitis. Pain is nearly always present; may be of exceeding severity and frequently appears to center about the site of injury. There is always a certain degree of shock, which tends to vary to a large extent with the severity of the hemorrhage. Some surgeons lay a great deal of stress on the obliteration of the normal liver dulness in the diagnosis of perforation of the stomach and duodenum.[1] In every case of perforation gas and fluid are present in varying amounts in the free peritoneal cavity. The gas may pass between the liver and diaphragm, as shown by the x-ray, and cause obliteration of liver dulness. Much dependence cannot be placed on liver percussion as ordinarily practised because of the great variations both in health and disease. If we change the patient's position, free fluid will flow to the dependent part and the air will rise to the top. This will intensify the diagnostic findings—tympany over a wide liver area and again flatness over the same area on change of position. Normally, there is a change in the liver percussion note on change of posture. This has been noted in a large number of normal cases examined, but in none of them were the results similar to those in the cases of perforation reported by Field. Normal liver changes must be recognized, however, before positive deductions are made. Usually this sign is not of great importance. If absent in the presence of other positive signs of perforation, it may be disregarded, but if present in doubtful cases, it may be the deciding diagnostic factor.

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[1] Field: Gastroduodenal Perforation; a New Diagnostic Sign, Boston Med. and Surg. Jour., 1918, vol. 178, p. 220.

The patient has been prepared and I am making my incision over the middle of the left rectus muscle from the rib margin down to about the level of the umbilicus. Opening the peritoneal cavity, a small amount of fluid escapes, the stomach comes immediately into view, and on its anterior wall about $1\frac{1}{2}$ inches above the middle of the greater curvature is a perforation, through which mucous membrane protrudes. There is no material escaping from this wound. It is rapidly closed by two purse-string sutures (Fig. 336, 1). Since the bullet entered the back, we are certain that the posterior wall of the stomach has also been wounded. Tearing through the great omentum we find, at a point directly opposite the hole in the anterior wall, a similar perforation on the posterior wall of the stomach, through which stomach contents are escaping. This also I close with a purse-string overlaid by a Lembert suture, and then search for other wounds (Fig. 336, 1, 2). The mere fact that an anterior and posterior perforation has been discovered and closed does not rule out the possibility of other perforations. Norman Kerr recently described such an instance. The patient, a man of about sixty, was shot in the back about one-half hour after he had eaten a heavy meal. The bullet divided the right ureter after

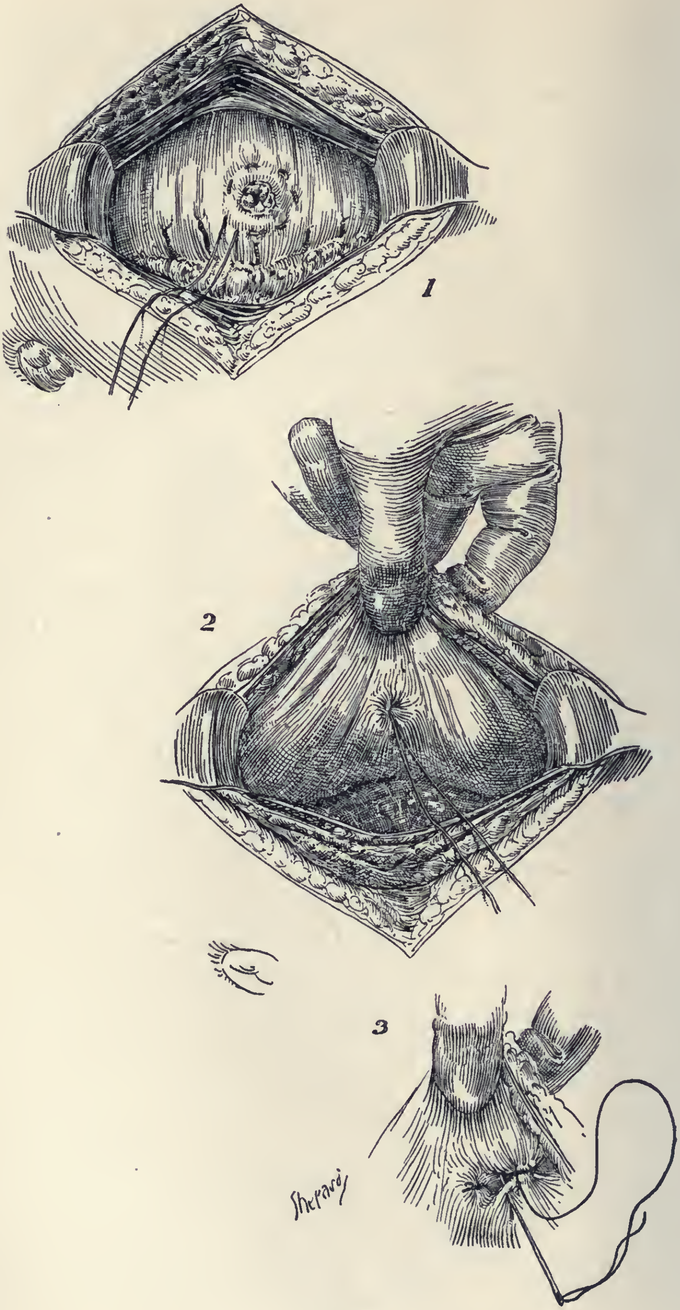

Fig. 336.

entering the pelvis of the kidney, then made three perforations of the right portion of the stomach about 2 inches to the left of the pylorus, one on the posterior wall, one in the anterior wall just opposite, and another on the lesser curvature just above the line of the other two—this last one was overlooked and the patient died in twenty hours. The explanation of such an accident is as follows: There are usually three contraction waves in the digesting stomach which can be seen on the fluoroscopic screen at the same time, and each wave, as it passes toward the pylorus, becomes quite deep, thus making it possible for a bullet to graze or even perforate the tip of one of these inverted crests as it passes through the stomach.

It is possible that a patient may survive a perforation of the stomach; there are a number of such instances on record. When such wounds heal spontaneously they produce small, herniated diverticula of the mucous membrane, the production of which is explained in the following manner: when the stomach is perforated the mucous membrane immediately protrudes through the opening and may even plug it sufficiently to prevent leakage; the herniated mucous membrane remains herniated and gradually becomes covered with a layer of fibrin which slowly organizes and seals the hole, the herniated mucous membrane still forming a diverticulum.

I have explored the lesser peritoneal cavity and the region in the neighborhood of the wound of entrance and can find no evidence of injury to other structures in that locality. As it is possible, however, that I may have missed a wound of the tail of the pancreas or of the left ureter, I will insert a cigarette drain deep in the left hypochondrium and close the wound in layers. Ordinarily drainage is not required in gastric perforations which are treated early, and irrigation of the peritoneal cavity also, as a rule, is not required. Simply mopping up of the escaped gastric contents, as I have done in this instance, is sufficient.

Fig. 336.—1, Abdomen opened; perforation in anterior wall of stomach presenting; purse-string suture in place preparatory to closing perforation. 2, 3, Closure of perforation in posterior wall of stomach by purse-string overlaid by Lembert sutures.

We will send this patient back to his bed. He may lie flat or be elevated on pillows, according to which position is the most comfortable. He will be given 8 to 10 ounces of normal salt solution per rectum every four hours, nothing by mouth, and enough morphin to prevent great suffering. In about thirty-six hours we will allow small quantities of water by mouth, to be followed in twelve hours by regular feedings of milk and Vichy, each $\frac{1}{2}$ ounce every hour, quantity to be increased the following day, and about the fourth day we will allow strained gruels, soft-boiled eggs, and cereals in addition to the milk, and in from ten days to two weeks have the patient back on a full tray. If he shows any tendency toward hyperchlorhydria we shall continue his milk and cereals over a longer period and add alkalies between feedings. We commonly use sodium bicarbonate and calcined magnesia, or sodium bicarbonate and calcium carbonate, each 10 grains, as the alkali.

While operating on this patient we have used ether anesthesia. General experience seems to indicate that ether should be the anesthetic of choice in most cases of this type. Quite uniformly bad results have followed spinal anesthesia in operations for gastro-intestinal perforations. The spinal anesthesia seems to greatly enhance the tendency of such patients to sink into deep shock, from which they do not recover. The results under chloroform, while better than those obtained under spinal anesthesia, are not nearly as favorable as those obtained by ether. Local infiltration anesthesia, while to be considered, probably would not be satisfactory, because of the marked increase in operating time necessitated by its use, and because of the wide exposure frequently necessary in these cases, which would be very difficult to obtain readily and quickly in the ordinary infiltration anesthesia.

The prognosis for this patient should be very good. It is well known that the mortality following gunshot wounds of the gastro-intestinal tube is directly proportional to the time elasping between the receipt of the injury and suture of the perforation. The maximum period of successful suture after injury is approximately thirty-six hours, and the prognosis depends largely on the amount of hemorrhage that has taken place and on the association of wounds of other organs; the amount of peritonitis present does not appear to depend very directly on the length of time between the injury and the operation. As has been noted, spontaneous recovery may occur. In the Cuthbert Wallace series there were 82 cases of stomach wounds, only 27 of which were associated with wounds of other portions of the intra-abdominal gastro-intestinal tract. Of 55 cases of stomach suture without involvement of other organs, 29 died. Of 27 cases associated with other operations on the intestinal tube, 21 died. The mortality uncomplicated with injury of other hollow viscera was 52.7 per cent; with other hollow viscera involved, 77.8 per cent. There were a small number of pancreas and spleen injuries associated with stomach injuries, but the series was too small to warrant definite conclusions, although most of these patients died and it was suggested that such complications made the prognosis very grave.

Postoperative complications which may arise following gunshot wounds of the stomach are ulceration, secondary hemorrhage, perforation, and local abscess—the latter, in stomach cases, is usually subdiaphragmatic.

In conclusion I would like to say a few words in regard to the type of wounds produced in the stomach by bullets. Bullets passing anteroposteriorly as a rule make small wounds, such as the ones which we have just seen. When the axis of flight of the projectile is more or less parallel to the walls of the stomach, the wounds become larger, sometimes cutting the entire wall of the stomach for a great distance, sometimes a mere linear slit in the outer coats followed by perforation; when the projectile passes in through the epigastrium and out by the axilla the wounds tend to become parallel to the greater curvature; when the missile takes a more vertical course the wounds are inclined at an angle to the greater curvature, and the anterior wall of the stomach, or its antral portion, may be almost completely divided. Projectiles hitting the greater or lesser curvature in an anteroposterior direction sometimes cause rather extensive V-shaped injuries involving both walls. Bruises or

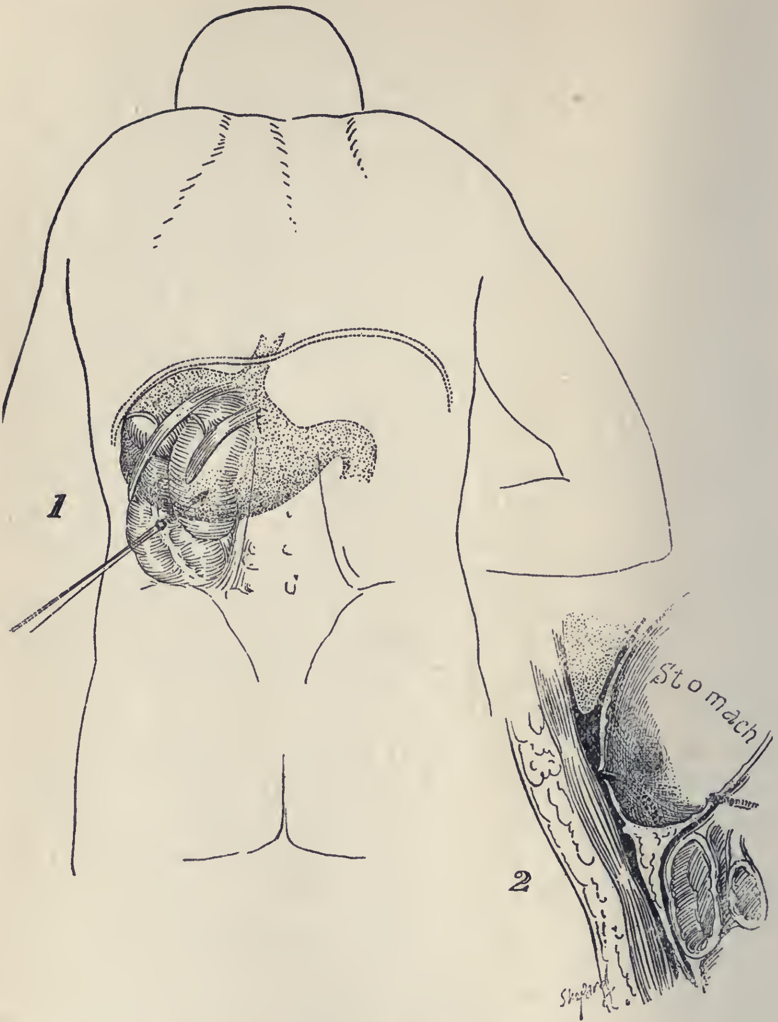

Fig. 337.—1, Point of entrance and probable course of bullet, lateral to kidney and medial to descending colon, entering the lower border of the stomach. The patient is shown in outline in a stooping posture simulating that which he assumed while running for safety; this helps to explain how the bullet missed kidney and colon and reached the stomach. 2, Bullet has perforated posterior wall of the stomach, is spending its force on anterior wall of stomach and anterior abdominal wall. Dotted lines indicate probable rebound of bullet into stomach, from which it was probably ejected during the act of vomiting.

cuts in the peritoneum or muscular coats without perforation are not infrequently met with. They may occasionally give rise to general peritonitis. Hemorrhage, when it occurs, is frequently quite severe, and comes from the vessels on the surface of the stomach rather than those in the stomach wall.

Having the abdomen closed, what shall we do with the wound of entrance in the back? (Fig. 337, 1) There seems to be some difference of opinion in regard to the management of these wounds. Cuthbert Wallace concluded that excision was not necessary. Many other surgeons in the War Zone excised such wounds as a matter of routine. In civil practice there is rarely any reason for doing anything more to a wound of this type than mere cleansing with peroxid or tincture of iodin and the application of a sterile dressing. Such will be our procedure in this case.

Postscript.—The patient made an uneventful recovery and was discharged from the hospital on the twenty-first day after operation, wounds completely healed.

The patient was very anxious to know the fate of the bullet which had entered his body and which we had not found at the operation. Careful *x*-ray examination of his entire abdomen and pelvis was therefore made before he left the hospital, but no evidence of the bullet was found. It seems probable that the bullet, after entering the stomach, perforated but did not pass through the anterior wall of the stomach in its entire length, spent its force on striking the anterior abdominal wall which was in contact with the stomach, and then dropped back into the gastric cavity (Fig. 337, 2). It was probably ejected in the vomitus during the course of the rather violent attacks of vomiting which the patient experienced before reaching the hospital.

CLINIC OF DRS. KARL A. MEYER AND W. F. MONCREIFF

Cook County Hospital

URINARY EXTRAVASATION

Summary: Etiology of urinary extravasation; spontaneous cases nearly always septic; principles of treatment; suprapubic puncture not followed by permanent drainage indefensible.

Extravasation of urine from the bladder or urethra into the surrounding tissues may be considered as traumatic or non-traumatic (spontaneous). There are four important groups of the traumatic cases from the etiologic viewpoint. The first includes severe trauma, oftentimes crushing injuries, with fracture of the pelvic girdle, and sometimes a concomitant injury to the rectum. A second group comprises penetrating wounds of the bladder or urethra. In the third group we have a relatively slight trauma to an overdistended bladder. Rupture of the urethra by instrumentation forms a very important group in which trauma is the determining factor, notwithstanding the fact that the sounding or catheterization is undertaken with the object of relieving an obstruction and retention of urine due usually to an organic stricture.

Retroperitoneal or perirenal extravasation of urine may occur from trauma of the first or second type mentioned, involving the pelvis of the kidney. This is what occurred in one of the patients (E. M.) presented to you.

Non-traumatic or so-called spontaneous extravasation of urine occurs as a result of urethral obstruction, which means practically always gonorrheal stricture and its consequent pathology. A very important clinical feature of these cases is the septic urine, which the stagnation and retention invariably produce. We have two patients illustrating this type of extravasation.

In the case of this boy (E. M.) of fourteen, we have dealt with a traumatic extravasation of urine from the kidney pelvis. He was admitted to the hospital about four hours after sustaining a compression injury (between two vehicles), complaining of pain and tenderness over the left side of the abdomen and vomiting. He did not lose consciousness at the time of injury or afterward. About one hour after the accident he vomited, and since then three or four times before entering the hospital. There was abdominal tenderness and rigidity, more marked on the left side, where there were also some skin abrasions. His temperature, pulse, and respirations were normal, and his general condition good. A diagnosis of kidney injury was made. Exploratory laparotomy revealed discoloration and infiltration of the retroperitoneal tissues lateral to the descending colon; there was a complete rupture of the pelvis of the kidney, with infiltration of a considerable amount of urine into the perirenal tissues. The renal vessels were intact, and consequently there had been no bleeding of consequence. There was no intraperitoneal injury. An immediate nephrectomy was done; no drainage was used, as sterile urine causes little if any reaction, and is rapidly absorbed unless necrosis occurs.

Postoperative Note.—An uneventful recovery followed the operation, and the patient was able to leave the hospital in two weeks.

Our next patient (J. H.), a railway switchman, is a typical example of the very important group of cases of spontaneous extravasation of septic urine due to chronic urethral obstruction. This man was admitted to the hospital complaining of pain and marked swelling of the scrotum, perineum and lower abdomen, and inability to urinate. Two and one-half years ago he had acute gonorrhea, self-treated, which continued as a chronic process from that time to the onset of the condition for which he now seeks relief. For some time before this acute condition appeared he had noticed that the urinary stream was small; and just a week before, following some heavy work, he was seized with chills. A few days afterward, swelling, localized tenderness of the perineum and scrotum appeared, and this was followed by swelling and soreness of the penis, with extension of the same condition upward into the suprapubic region. Before entering the hospital he had been using hot dressings, ointment, and methylene-blue under the direction of his family physician. He states that there had been no previous attack of a similar kind.

The patient was acutely ill on admission to the hospital. Temperature was 100° F., pulse 120, respirations 28. Leukocyte count 17,600. Swelling, tenderness, and rigidity were marked over the lower abdomen, especially the suprapubic region; much less intense over the upper abdomen. The tenderness appeared to be in the abdominal wall itself. Some redness of the skin was present toward the base of the penis. The external genitalia were markedly swollen and distorted; the scrotum being swollen to 10 inches diameter and very tense, red, and tender. The penis was swollen and distorted and large areas of the skin were black in color, due to gangrene. Urine was dribbling from a fistula at the junction of the penis and scrotum. The perineum was swollen, red, tense, and tender. Considerable tension and tenderness of the perirectal tissues was revealed by rectal palpation.

Operation.—Under ether anesthesia a suprapubic cystotomy was done, liberating about 2 liters of putrid urine. A large rubber tube was sutured into the bladder for permanent drainage. Multiple incisions were made into all the swollen and infiltrated tissues of the abdomen, scrotum, and penis, and hot dressings with saturated boric solution applied.

Postoperative Course.—Sitz-baths of twenty minutes each were used twice daily, increasing the duration as the strength of the patient returned; urotropin and acid sodium phosphate were given by mouth. For several days there was a profuse foul discharge from the infected tissues; with separation of gangrenous sloughs the discharge soon ceased.

After-treatment.—After five weeks the suprapubic wound was entirely closed, and the remaining wounds were healed so that the patient was able to leave the hospital. He was then referred to Dr. Harry Culver, who succeeded with filiforms and sounds in dilating the strictures to 24 F.

Our next patient (H. P.) is an example of the same type of extravasation. He entered the hospital because of swelling of the penis and scrotum and inability to urinate. Extreme difficulty in urination had been present for three days. There is a history of more or less urinary obstruction, dating back to an attack of acute gonorrhea eight years before, but no previous acute condition like the present trouble. The penis and scrotum were very greatly swollen, the perineum not affected. The marked infiltration of the penis precluded any attempt to relieve the obstruction from below. The bladder was drained by a suprapubic cystostomy, and a retrograde catheterization performed. An impassable stricture was found at the penile-scrotal junction, which was incised externally, and a retention catheter sutured into place. Suprapubic drainage was continued for one week to allow healing of the urethra; the wound was then allowed to close (Fig. 338).

The observations of Wolfer (S. G. O., 1918, xx, 56, 296) on this subject coincide closely with my own experience in dealing with these cases. The seriousness of urinary extravasation is influenced very materially by the factor of chronic urethral obstruction with its consequent stagnation, decomposition, and infection of the urine. A considerable amount of sterile urine may infiltrate the tissues, with very little reaction, and absorption without ill effects, provided the injury to the urinary tract receives prompt surgical treatment, before necrosis and secondary infection occur as a result of a continued infiltration and decomposition of the urine. This benign course is usual in extravasation of the purely traumatic variety.

Spontaneous extravasation, on the other hand, means an infiltration of the tissues with septic and decomposed urine. Rupture of the urethra in these cases results from continued straining in an effort to empty the bladder. This takes place the more easily when there are ulcers of the mucous membrane behind the stricture, or a peri-urethral abscess separated from the lumen of the urethra by a very thin wall. With the primary septic extravasations should be included the group of traumatic cases in which the urethra is ruptured by instrumentation, in an effort to empty the bladder from below. The chronic urethral obstruction with which we are dealing in these cases is practically always the result of gonorrheal strictures, which are very often multiple. The acute retention which precedes extravasation is usually the immediate sequel of an alcoholic debauch.

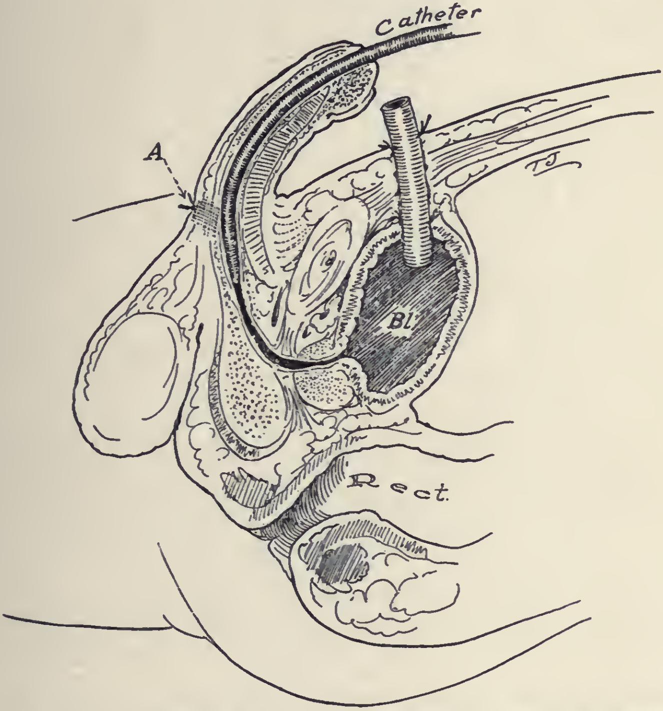

Fig. 338.—Impassable stricture at penile-scrotal junction incised externally, skin wound sutured and catheter anchored in urethra; suprapubic drainage maintained until wound in urethra has healed.

The treatment is largely a matter of following accepted surgical principles. The indications are to establish drainage of the bladder in a rational manner; to combat the infection of the infiltrated tissues; and later to re-establish the continuity of the urethra by the methods most applicable to the conditions as they exist in each individual case. Suprapubic puncture, though still employed in some quarters, is a dangerous and unsurgical procedure, usually being followed by severe or even fatal infection. The reasons for this are fairly obvious. There is no peritoneal covering at the site of the puncture in the bladder wall to seal the opening; even if there were, it is doubtful whether the danger would be eliminated. As the bladder refills, urine leaks through the valve-like puncture tract into the reticular tissues of the prevesical space, whence it infiltrates the perivesical tissues back to the anterior aspect of the rectum, initiating an infection in this region very difficult of surgical access. Suprapubic puncture is indefensible under any circumstance unless perhaps one immediately afterward establishes continuous drainage by suprapubic cystostomy. The method of choice in these cases, then, is immediate suprapubic cystostomy, multiple incisions, and free drainage of the infiltrated tissues, with hot fomentations to the infected tissues, sitz-baths, and urinary antiseptics by mouth. Irrigation of the bladder may be done with advantage. The prognosis is obviously the more favorable the earlier the diagnosis and the surgical intervention are made. Later, after the sepsis has been cleared up, and the patient is in good general condition, the continuity of the urethra is to be re-established either by dilatation from below, retrograde sounding and external urethrotomy, or internal urethrotomy, or a combination of these measures according to the special conditions met with.

RETROPERITONEAL WOUNDS OF THE COLON

Summary: Report of case, with autopsy findings; high mortality of retroperitoneal wounds of the colon; pathology; treatment.

We all admit the great value of mistakes as teachers of medicine. In presenting this autopsy report I trust that it may serve to bring home to us the importance of and the diagnostic difficulties associated with extraperitoneal wounds of the colon.

History.—J. A., a male Italian laborer, aged twenty-two, entered the Cook County Hospital April 24, 1919, bleeding from a gunshot wound of the trunk. About one hour before admission he was shot from behind by a union laborer because of a labor dispute. Some bleeding from the wounds occurred in transit to the hospital.

His previous health had always been good; personal and family history contained nothing of significance.

Physical Findings.—When first seen the patient was in great pain and exhibited a moderate degree of shock; there was bleeding from a wound of entrance in the left lumbar region, situated at the level of the third lumbar vertebra, about 1 inch to the left of the midline. The wound of exit was situated on the left side, about 1 inch above the iliac crest, midaxillary line, and there was also bleeding from this wound. A superficial wound tract, about 3 inches long, of no consequence, beneath the skin and superficial fascia, was found laterally over the left eighth and ninth ribs. There was diffuse tenderness over the left half of the abdomen with slight rigidity of the abdominal wall. No other physical findings of any significance were noted.

Diagnosis.—Perforation of an abdominal viscus was suspected, and a laparotomy was done at once.

Operation.—Abdomen opened through left paramedian incision below umbilicus. Careful exploration revealed no visceral lesion, no perforation of the peritoneum. Palpation through the peritoneum outlined the track of the projectile which had torn its way through the deep lumbar muscles on the left side. The abdomen was closed in the usual manner.

Postoperative Course.—The patient left the operating room in good condition and apparently continued to do well for the next eighteen hours. He then became restless, began to vomit, and complained of considerable abdominal pain; there was a slight rise of temperature (99.8° to 100.2° F.), respirations increased to 28 or 30, pulse averaging 124 to 130. The next day a moderate distention of the abdomen was noted—vomiting continued at intervals, and there was a slow progressive increase in pulse-rate and respirations. The temperature remained at about 100° F. A diagnosis of peritonitis was made, and on the evening of the second day after operation, under gas anesthesia, a drain was inserted through the lower angle of the laparotomy wound. The condition nevertheless continued to grow progressively worse, with increasing abdominal distention, severe pain in the abdomen and left lumbar region, hippocratic facies, fever of 104° to 105° F., and a continued increase in pulse-rate and respiration. Restlessness increased to delirium, respirations became irregular, shallow, and entirely costal. Death occurred at 2.40 P. M., April 28, 1919, the third day after operation.

Postmortem Findings.—The cause of death was a retroperitoneal wound of the colon at the splenic flexure, with secondary septic cellulitis of the retroperitoneal tissues, from leakage of bowel content, and septic peritonitis, the infection having involved the peritoneum apparently by direct continuity from the retroperitoneal tissues. It was found that the projectile had not penetrated the peritoneal cavity nor produced any wound of the peritoneum.

Retroperitoneal wounds of the colon are associated with a very high mortality under all circumstances. Furthermore, the anatomic conditions are such that, owing to the absence of a mesentery of the ascending and descending colons, these portions of the large bowel are especially liable to injuries of this type. For the same reason the duodenum is also very liable to retroperitoneal injury. Cuthbert Wallace states that of the wounds of the colon met with on the British and French fronts, extraperitoneal injuries formed a rather considerable proportion. These wounds are nearly always produced by missiles which enter the loin or lumbar region just lateral to the vertebral column and pass outward on the same side, taking an oblique forward direction in their course through the tissues. Intraperitoneal and extraperitoneal wounds of the colon have sometimes been found coincidently, either at operation or autopsy.

Several factors are responsible for the high mortality of these retroperitoneal lesions. Exact figures are not available, but a mortality of 90 per cent., as compared with an average of 50 to 60 per cent. in the purely intraperitoneal wounds, is probably not an overstatement. The first important factor to be considered is that of diagnosis. The ordinary anterior laparotomy incisions do not give an adequate opportunity to gain information as to the presence or location of a retroperitoneal wound of the colon. Furthermore, the presence of through-and-through wounds of the peritoneal surface does not exclude the possibility of further retroperitoneal wounding. The areolar character of the retroperitoneal tissue makes it difficult to find these wounds even when exploration is made through a lumbar incision. Many of them are small and tend to remain partly closed. Hemorrhage into retroperitoneal tissues, particularly the massive retroperitoneal hematoma that is a fairly frequent accompaniment of these lesions, adds further to the difficulty of finding them. It is anything but an easy task to suture the bowel wall in this locality, due partly to the lack of a peritoneal coat, partly to the difficulty of access to the region. Owing to this latter consideration, wounds in the region of the splenic flexure are the most difficult to manage.

A second factor, of perhaps greater importance than the other, is the extreme virulence and rapid course often exhibited by infections of the retroperitoneal tissue. Infection may be initiated either by leakage of the bowel content or by material carried in by the projectile; the latter cause is of greater importance in war wounds than in those met with in civil practice.

No mention seems to have been made by others of the occurrence of general peritonitis by extension from the retroperitoneal sepsis, which was a special feature of the picture in the present instance. Drummond and Dunn have called attention to a special type of wound met with in military surgery, in which the projectile does not perforate the bowel directly, but the escape of fecal material into the retroperitoneal tissue, and consequent infection, results from a rapid ulceration of the mucosa. This ulceration is said to occur within a few hours of the injury, and is due to separation of the muscular wall and submucosa from the mucous membrane with consequent loss of blood supply to the latter. The mechanism concerned in the production of this type of injury is thought to be the dragging force exerted by the projectile on the tissues surrounding its pathway.

The principles to be followed in dealing with extraperitoneal wounds of the colon, as contrasted with the intraperitoneal variety, are few, but important. The position and course of the track of the projectile in the body, as indicated in a general way by the location of the wounds of entrance and of exit (when the latter is present), deserve special consideration. If these are so situated as to indicate a reasonable possibility of a retroperitoneal lesion of the bowel, it is probably safer to explore than not. A posterolateral lumbar incision should be made, so placed as to admit of careful and thorough examination of the entire wound tract in the colon region of the side in question. Suture of the wounds in the bowel wall should be done if practicable; in any event, free drainage is of the greatest importance.

In conclusion, it may be stated that in view of the special liability of the retroperitoneal tissues to infection, and of the technical difficulties attending the operative treatment of these lesions of the colon, their mortality will probably continue to be high even under the most favorable conditions.

CLINIC OF DR. HUGH McKENNA

St. Joseph's Hospital

POSTOPERATIVE HERNIA. NECESSITY OF APPROXIMATING FASCIAL LAYERS. LOCAL ANESTHESIA AS A PREVENTIVE OF RECURRENCE

This patient was originally operated on for appendicitis, at which time an incision was made through the right rectus muscle. I must condemn this incision, as it destroys the action of the muscles and retards healing because of the muscle paresis. The patient was operated on for the repair of the hernia on two previous occasions, but each time it recurred. In the repair of this hernia this morning I shall attempt to carry out the Mayo operation of flap over flap.

The patient is now prepared for operation, which I shall do under ether anesthesia. I am making my incision through the old scar. The upper flap is now free, and I am carrying my dissection well back under the skin and then freeing the lower flap. It is not necessary to separate the fat from the upper flap, but the lower one must be entirely clean and fat free in order that the fascia overlying the muscles may come into intimate contact with the parietal peritoneum on the under surface of the upper flap. I am working with the fingers of one hand in the abdomen in order that I may more safely make my dissection and avoid the possibility of cutting through a little pocket of the hernial sac that might contain adherent bowel. I am freeing the skin from the old scar, which is very extensive, before attempting finally to prepare the lower flap. A principle that must be kept in mind in the repair of any type of hernia is that the two fascial layers must be brought together rather than an approximation of muscle to muscle or muscle to fascia. In the approximation of the fascial layers the operator must be careful not to leave a site for a potential hernia, which means that the layers of fascia must be very closely approximated in order to prevent a portion of the fat or omentum protruding between the approximating sutures, as when coughing or a sudden effort produces a strain on the abdomen there is very frequently a recurrence of the hernia. In a large number of hernias, probably 900, operated on in the service of which I was in charge during my active service in the army, where for the first period we were able to observe the patients operated on for a period of seven months, we had an excellent opportunity to note the possibilities of recurrence in patients who went into active duty immediately upon being discharged from the hospital. These operations were in the great majority of instances for various types of inguinal hernia, although every type, including postoperative hernias, were referred to the surgical department. Our conclusion in connection with this work was that doing the operation under local, thereby minimizing the coughing and vomiting after operation and the possibility of forcing tissue between the approximated layers, very markedly reduced the number of recurrences. In the operation for inguinal hernia, particularly the direct type, a modified Andrews' operation was used in the majority of cases, and in this operation great care was exercised after putting in the mattress sutures to bring the upper cut edge of the aponeurosis of the external oblique down to the shelving portion of Poupart's; and to make this step of the operation doubly secure before tying the mattress sutures a fine catgut continuous suture was utilized to bring this cut edge into immediate contact with the shelving portion of Poupart's. The lower cut edge of the aponeurosis was brought up over the cord and sutured to the superficial fascia. I may say in passing that the superficial fascia in this region in a large percentage of the cases is a well-developed fascia. A subcutaneous suture for closure was used in a fair percentage of these cases, and led us to the conclueion that the immediate approximation of the skin edges was a very important factor in preventing the possibility of infection, thereby reducing the number of cases of recurrence.

In this case the remnants of the recti have retracted into a large muscular ridge on either side, making the imbrication operation difficult and also preventing the possibility of bringing the recti together. In the repair of large hernias many times we close the sac on the inside, and that method is a much safer one, particularly in the sliding type of hernia, and is a principle that may be utilized to a certain extent in any large hernia. Indeed, in a large inguinal hernia the lateral wall of the sac many times is made up of a part of the mesocolon, which manifestly cannot be removed, and yet the sac must be closed. This can be done best by a closure of the sac from the inside. In the first operation this morning, which we did under local anesthesia, it was necessary to close the hernial sac from the inside.

The anchor stitches are now in place. After these anchor stitches are pulled together I will attempt to carry out the principle I have already laid down, that is, the approximation of the upper surface of the lower flap to the under surface of the upper by means of a row of interrupted chromicized catgut sutures applied in the trough of the wound. The flap is now pulled down with three heavy silk sutures. The purpose of applying the sutures in the trough is to prevent the protrusion of a tongue of fat or omentum. A thing we must not overlook in these cases is that the lessening of the intra-abdominal space increases the pulmonary congestion and sometimes leads to a fatal issue both from pneumonia and pulmonary edema. The skin is closed with silkworm gut. In the dressing of these cases heavy strips of adhesive are passed around the abdomen to the back in order to relieve the strain on the stitches during the first twenty-four hours, especially when the patient is coming out from under the anesthetic.

RESECTION OF TIBIA—REPAIR OF DEFECT BY TRANSPLANTATION OF BONE FROM OPPOSITE TIBIA—SKIN-GRAFTING BY PEDICLED FLAP METHOD

This patient was operated April 7, 1917. The wound having for years been badly infected, it was necessary to remove all the sloughing tissue and the entire lower 7 inches of the tibia. Following operation the wound was treated with Dakin's solution until completely clean. Then a graft 9½ inches long was removed from the opposite tibia and transplanted into the defect. When an attempt was made to close the wound it was found that there was not enough skin to cover the transplant and only by splitting the tibialis anticus was it possible to get enough soft tissue to cover the graft. However, the graft healed in and the wound finally closed, leaving a very thin layer of soft tissue over the graft. The patient left the hospital June 30, 1917. As I had to leave for military service and could not keep the case under observation, the patient began using the leg earlier than she should, with the result that she fractured the graft at the point where the soft tissue was thinnest. When I finally had an opportunity to operate on the case I found that the repair of the fracture had increased the size of the bone graft, thereby necessitating the application of a heavy skin graft. This was done by cutting out a tongue-shaped pedunculated flap of skin and fat down to the fascia lata on the outer side of the right thigh and applying it to the defect over the angle, the flap being held in position by means of a plaster-of-Paris cast for three weeks. The flap was then detached without anesthetizing the patient. It is now five weeks since the flap was detached and you can see that it covers the defect beautifully (Fig. 339).

This case is presented with considerable interest because it shows certain principles in plastic operative surgery that can be brought about where the surgeon will give the time and extreme care necessary to get these results, and where the patient, in turn, is willing to give the necessary time.

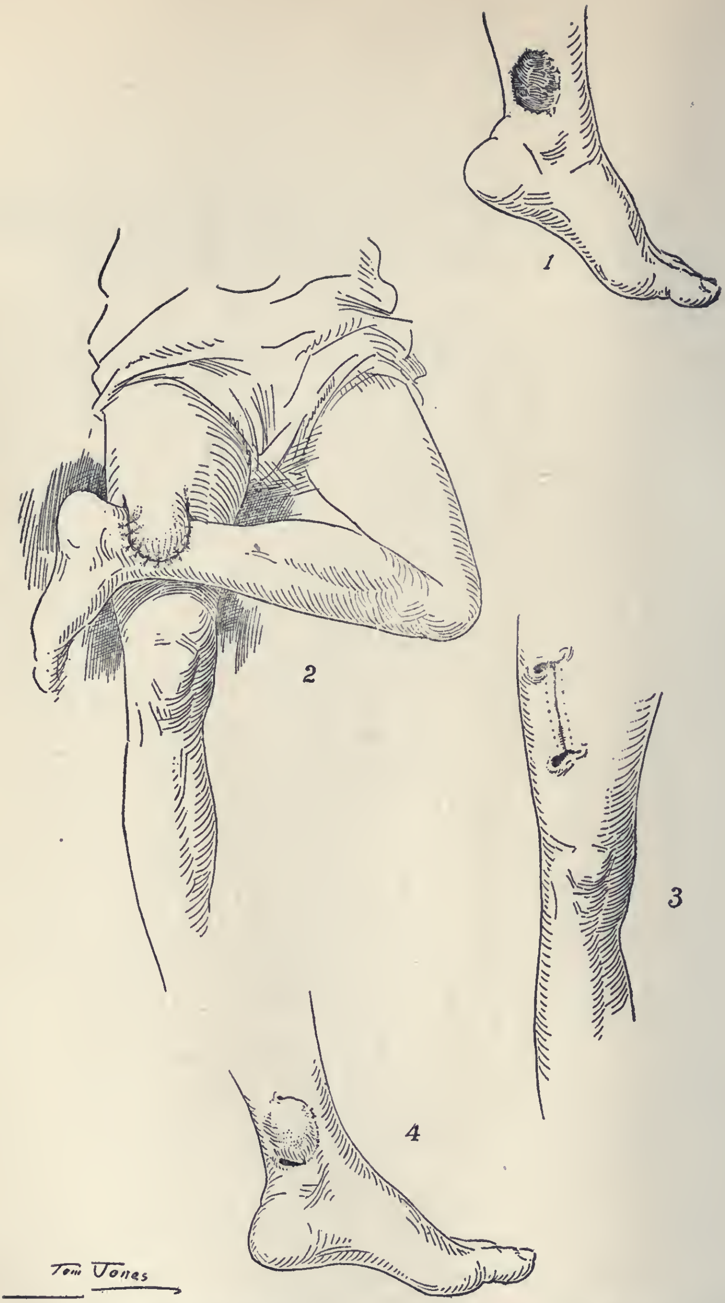

Fig. 339.—Resection of tibia. 1, Cutaneous defect at site of healed fracture in transplant. 2, Pedicled flap stitched in position. 3, 4, Site of removal of graft from thigh and its new location on the leg after healing occurred. Note that the wound in thigh, as indicated by the stitch holes, was closed by suture.

DESTRUCTION OF FIBULA FROM OSTEOMYELITIS—TRANSPLANT TO REPAIR DEFECT

The next case I wish to present this morning is a girl twelve years of age, whose left fibula was practically entirely destroyed from an osteomyelitis occurring a year and a half ago. There remains a segment of the head of the fibula 2½ inches in length and a small delicate fragment at the lower end about 3½ inches. This wound had been healed for over a year when the patient began to show eversion of the foot owing to the lack of sup-

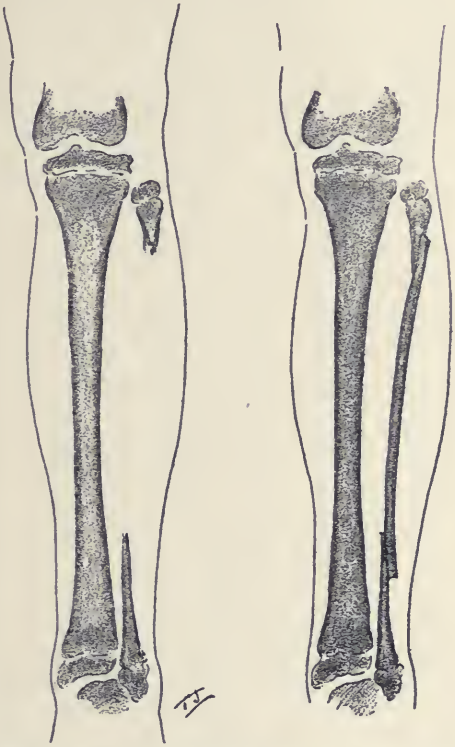

Fig. 340.—Destruction of fibula. Sketch made from *x*-ray picture taken before and after defect in fibula had been filled by bone transplantation.

port from the absence of a fibula. A graft 9 inches in length was taken from the tibia of the good leg, great care being exercised in removing this graft not to interfere with the epiphyseal areas. An incision about 3 inches in length was prepared in each end of the leg over the proposed new bed for the fibula and a long forceps was introduced through the upper wound and a path tunneled through the muscles down to the lower one. The graft was caught in the bite of a long forceps and pulled into place and made secure by the use of chromicized catgut applied around the ends of the graft and the segments of the fibula. The wounds were closed and the leg dressed in a posterior plaster-of-Paris splint. The wound healed by primary intention. It is five weeks since the operation and the progress of the patient has been uneventful (Fig. 340).

EMPYEMA—REMOVAL OF PUS WITHOUT COLLAPSE OF LUNG THE GREAT ESSENTIAL

The next patient is a child eight years of age, with fluid in the left pleural cavity. We aspirated 215 c.c. of the fluid. It was thought from the appearance of the fluid at the time of aspiration that it was pus. My experience in the management and observation of a large number of cases of empyema in the army has served to teach me that unless one gets positive cultures from these cases the pleural cavity should not be opened. My experience in the treatment of empyema has led me to believe that we should consider the keeping of the chest wall intact as an important factor in the handling of these cases. A review of the literature of the last couple of years will show that wherever the pleural cavity is opened according to the old plan of costatectomy or thoracotomy the cavity is immediately contaminated with various types of bacterial flora. Two principles must be kept in mind in the treatment of empyema. The first is the removal of pus from the pleural cavity at the earliest time possible by an operation carrying the least amount of shock to the patient, and the second is to reduce the possibility of collapsing the lung to a minimum. I am of the opinion that the plan of operation worked out by my associate, Dr. Victor P. Diederich, and myself at Camp Pike contains these attributes.

The technic of this operation is as follows: After the determination of pus by laboratory tests, physical findings, and *x*-ray picture, a No. 14 French catheter or a similar size Dakin's tube is introduced into the pleural cavity by means of a trocar and cannula. After the introduction of the cannula the trocar is removed, a catheter is introduced, and the cannula withdrawn. The trocar is introduced in such a way as to produce a valve action on the catheter, thereby preventing the introduction of air into the pleural cavity. The first pus that is removed by aspiration is sent to the laboratory, where 1 c.c. of the undiluted pus is plated. The cavity is then washed out with Dakin's solution. This procedure is repeated five times each day and the pus sent every twenty-four hours to the laboratory for plating in order to establish a control on the type of organism and the progress the case is making. I am of the opinion that the next most important factor in the treatment of empyema after removal of the pus is the prevention of collapse of the lung in order to preclude the possibility of the formation of a sinus. I believe few surgeons have come to realize the fact that the fewest number of sinuses will follow operation for empyema if they take into account in the original operation the prevention of collapse of the lung.

CLINIC OF DR. HERMAN L. KRETSCHMER

Presbyterian Hospital

A CASE OF VESICOVAGINAL FISTULA

Summary: Vesicovaginal fistula following hysterectomy for fibroids; diagnosis; methods of locating vaginal and bladder openings; importance of careful cystoscopic exploration in the differentiation from ureterovaginal fistula; complications; their treatment; technic of operation for closure of vesicovaginal fistula; postoperative result in present case.

Mrs. C. P., referred by Dr. Rachel Yarros.

Present Complaint.—Loss of control of urine. This loss of urinary control is more marked during the day, when urine escapes every ten or twenty minutes. During the night she has intervals of four hours without any escape of urine. In other words, as long as she lies on her back the urine does not leak. As a result of this leakage of urine, as the patient calls it, she is obliged to wear pads continually. She is confined to the house and is practically invalided.

Onset and Course.—In October, 1917, an abdominal hysterectomy was performed for fibroids, during which a severe hemorrhage occurred. After the operation the patient noticed the onset of the present symptom. This symptom has continued without any important change up to the present time.

Physical Examination.—The patient is a very large woman about forty years of age and not in any apparent distress.

Head and neck are negative. Heart and lungs are negative. Abdomen is negative. Nervous system negative. *x*-Ray examination for the presence of stone in the urinary tract negative.

Examination of Urine.—Clear, straw colored, neutral, no albumin, no casts. Sediment negative. Cultures sterile.

Cystoscopic examination of bladder is completely negative except for the presence of a large opening situated near the right ureteral orifice. During the cystoscopic examination it was necessary to keep the irrigating part of the cystoscope going because the boric solution used for filling the bladder ran out of this opening almost as fast as it was introduced. With a speculum in the vagina the fistulous opening could be seen. A ureteral catheter was then introduced through this vesicovaginal opening—it came out of this opening in the vagina.

The patient was told that she had a vesicovaginal fistula and operation for closure of the fistula was advised.

In this case because of the large size of the fistulous opening no difficulty was experienced in locating the vaginal opening of the fistula, and for the same reason the vesical end was readily seen with the cystoscope.

In instances where the fistulous opening in the vagina is small, difficulty may be experienced in finding it because of its small size. Occasionally the fistulous tract because of its small size may be hidden in some of the vaginal folds. It may then be difficult to differentiate between a small vesicovaginal fistula and a ureterovaginal fistula. This point can be definitely determined, as a rule, by ureteral catheterization. Either the catheter cannot be passed up the ureter because of the injury to it, or if the catheter is passed, and a large catheter used, the leakage of urine will stop. The vaginal opening may also be located by projecting a solution of argyrol into the bladder, after having first introduced a speculum into the vagina. This procedure may also be used to differentiate between a vesicovaginal fistula and a ureterovaginal fistula. In the ureterovaginal fistula the colored solution remains in the bladder and does not appear in the vagina.

Cystoscopy is of further value in these cases in determining the exact location of the vesical opening of the fistula and its relation to, or proximity to, one or the other ureteral orifice. If the fistula is located close to one of the ureters so that the ureter is in danger of being injured at the operation, one may fortify himself against such a possibility by catheterizing one or both ureters just prior to the operation.

Calcareous cystitis and occasionally bladder stones are found as complicating conditions revealed by cystoscopic examination. The value of careful and repeated cystoscopic examination in this group of cases is very evident, because, as is well known, severe cystitis, stone, and other intravesical complications are factors contributing to failure of the operation to bring a closure of the fistula. Should the cystoscopic examination reveal intravesical complications it is needless to say that these should be corrected before operative measures are undertaken.

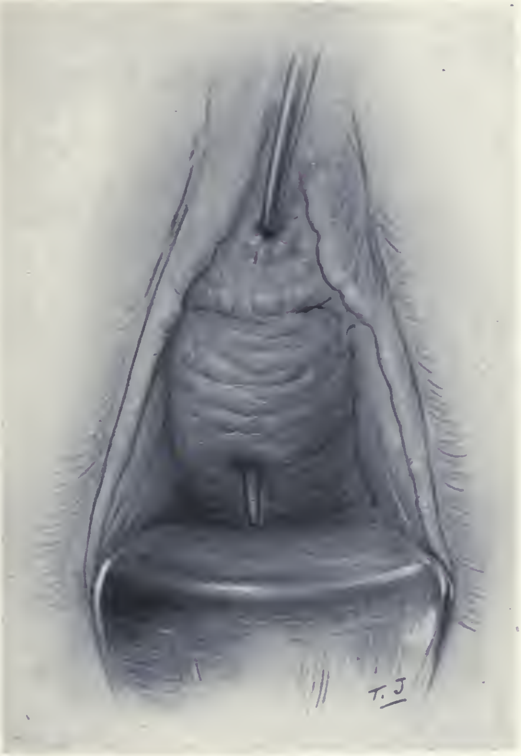

Fig. 341.—Demonstration of fistula. A male urethral sound has been introduced into the bladder and the tip of the sound brought out of the fistulous opening in the vagina.

In some instances as a result of the continuous leaking of urine with or without decomposition the vagina and external genitals become red, excoriated, and even may be the seat of phosphatic deposits, which add to the great distress of these patients.

Whatever complications may exist, they must be relieved by approriate treatment before the operation for closure of the fistula is underaken. If a stone is present this should be removed. Incrustations should be removed either by wiping with a sponge or they may be removed by means of a curet. Occasionally the ulcerations remaining require application of silver nitrate. To prevent the further formation of phosphatic deposits the internal administration of benzoic acid may be pre-

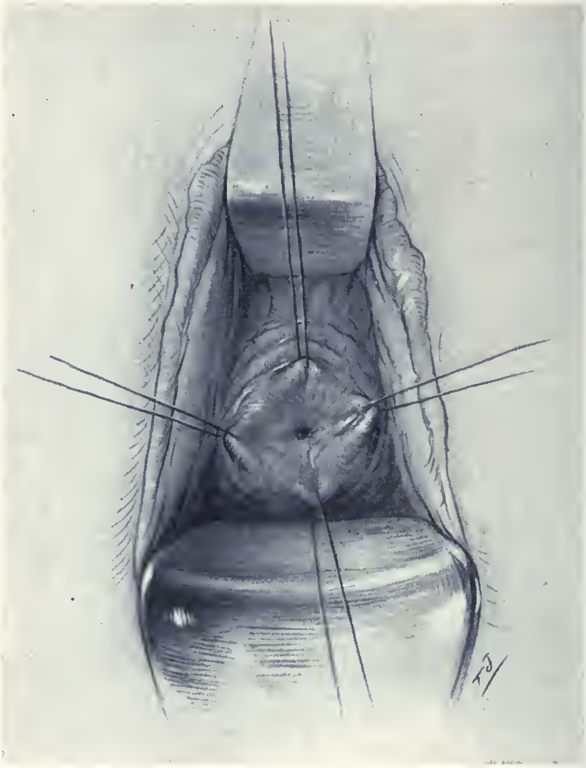

Fig. 342.—Fistulous opening brought as far forward as possible and thus rendered accessible by means of four silk traction sutures.

scribed. Hot vaginal douches and hot sitz-baths are of decided value in clearing up vaginitis when present.

Operation.—The patient has been anesthetized with drop ether. I will introduce a sound into the bladder and try to bring it out of the fistulous opening in order to demonstrate the fistulous opening to you. You can plainly see the tip of the sound as it emerges from the opening (Fig. 341). It is evident that the opening is situated high up in the vagina.

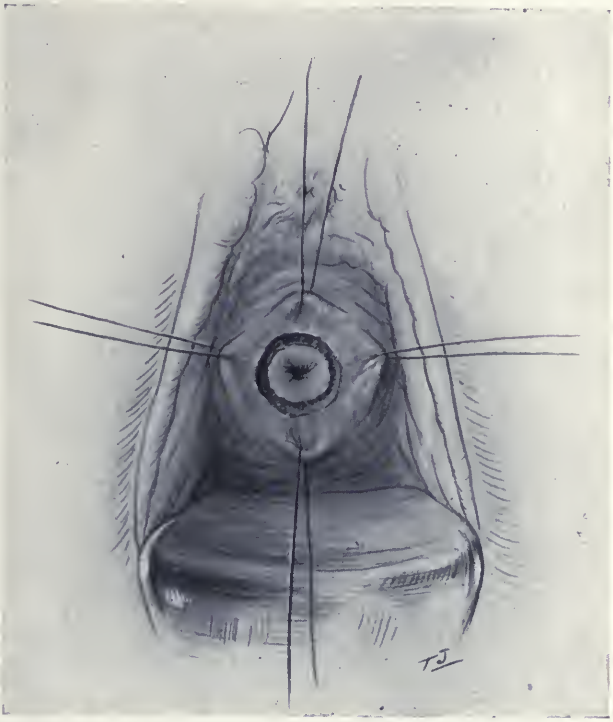

Fig. 343.—First step in the dissection—a circular incision around the fistulous opening.

In order to bring the opening as far forward as possible and to render the work more easy I am going to place four silk sutures around the fistulous opening. This, as you see, brings the fistula forward (Fig. 342). I will excise the fistulous tract by first making a circular incision around the opening (Fig. 343).

The circular incision will now be prolonged upward and downward, so as to allow a free dissection, separating the bladder from the vagina. I will continue the dissection so that the bladder can be mobilized. It is important to have the bladder dissection made as extensive as possible, so that the sutures can be placed without tension. As you see, I can now bring the cut edges of the bladder end of the fistula into very close apposition and without tension.

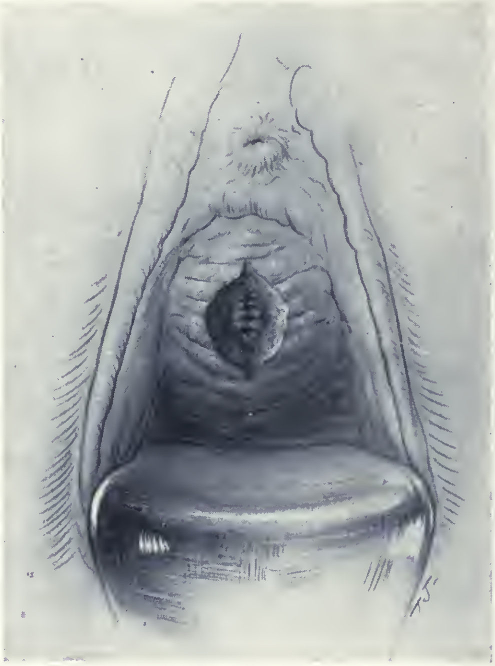

Fig. 344.—Closure of the bladder opening by catgut sutures.

By means of catgut sutures the opening has been closed (Fig. 344). These sutures pass through the bladder wall up to but not including the bladder mucous membrane. Having closed the opening in the bladder we will now close the vaginal mucous membrane with catgut, sewing this in the opposite direction to that in which the bladder mucous membrane was sewed (Fig. 345).

A small pack will be placed in the vagina and an indwelling catheter placed in the bladder.

Postoperative History.—The vaginal pack was removed on the third day. The vagina was douched with warm boric solution and another small pack introduced. The bladder was irrigated with a small amount of boric solution. Since operation there has been no leakage of urine, and the patient has remained dry ever since.

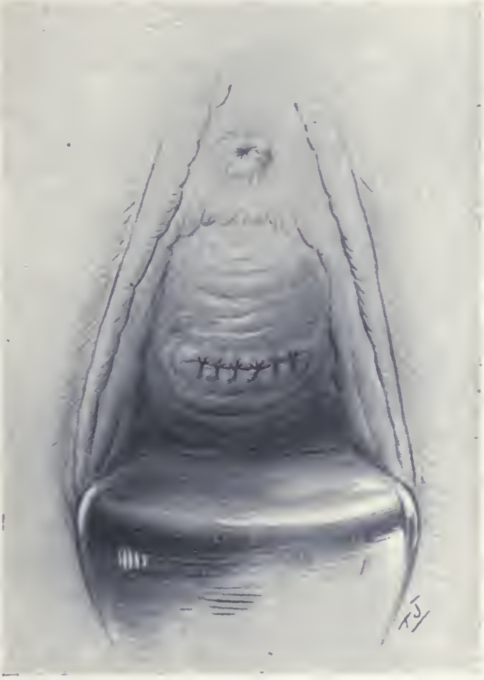

Fig. 345.—Closure of the vaginal incision. This is made in a direction at right angles to that of the bladder opening.

Cystoscopic examination made one week after operation showed no leakage during cystoscopy and a slough at the site of the previous fistulous opening was seen. Another cystoscopic examination made six weeks later showed the bladder completely healed. There was no sign of a fistulous opening or of the slough previously seen. The bladder capacity was 11 ounces. The patient has had no return of the former trouble.

CLINIC OF DR. EDWARD LOUIS MOORHEAD

Mercy Hospital

FLOATING KIDNEY

Summary: A patient presenting mild symptoms of intestinal obstruction associated with the presence of an abdominal mass; diagnosis; frequency and pathology of floating kidney; symptoms; indications for operation; technic of nephropexy; after-treatment.

This patient, aged fifty-six years, is married and the mother of one child, who is now eighteen years of age. She states that ten days ago she was seized with a severe pain in the right side of the abdomen. She became nauseated and vomited and was unable to obtain a bowel movement. A physician was called, and upon examination, he found the abdomen distended, and a lump, about the size of an adult's fist, a little below the umbilicus and to the right of the median line. He advised operation for the relief of the bowel obstruction, as he thought it was due to the presence of an abdominal tumor. Operation was refused, and by the administration of olive oil by mouth and the use of enemata a bowel movement was finally secured. The patient remained in bed for a week, and by the daily use of cathartics and enemata the bowels have moved slightly each day.

Patient was admitted to the hospital two days ago. There is nothing unusual in her personal history; no special sickness. Never knew that she had any abdominal tumor before the present attack. Always more or less constipated.

Menstruation began when she was thirteen years of age. Menopause occurred at forty-eight years. Menstruation has always been regular and not especially painful. No history of any disturbance of the genito-urinary system.

Physical Examination.—Patient is fairly well nourished. Head, neck, and thorax negative.

Abdomen.—Slightly distended. A definite tumor mass apparently about the size of an adult's fist is found on the right side of the median line and extending below the level of the umbilicus. This tumor mass does not move with respiration. It is not very painful to touch, is but slightly movable, and there is dulness upon percussion, the tumor mass apparently being against the abdominal wall, without the interposition of any bowel.

With this history as given to me, without any previous complaint on the part of the patient, the question naturally arises: What is the nature of this tumor mass and what is its anatomic location? Upon the answer to this question depends the line of procedure to be adopted in treating the case.

The urinary findings are negative. Bimanual examination does not reveal to me that the mass is connected with the uterus, although its position corresponds quite nicely to that of an ovarian cyst, in which the pedicle may have become twisted slightly at the time of the acute attack, or possibly a pedunculated fibroid. There is marked tympany between the mass and the lower border of the liver, and the absence of movement of the mass during respiration probably excludes the gall-bladder. The temperature and pulse are practically normal, as is also the leukocyte count, and, therefore, I think we can rule out acute appendical inflammation with a resultant abscess formation. Of course, malignancy involving the bowel or retroperitoneal structures must not be lost sight of. This brings us to a consideration of the possibility of the tumor mass being a floating kidney which, as a result of a localized inflammatory process, has become fixed in the position it now occupies. The patient has been examined under the fluoroscope and several *x*-ray plates have been made, after the ingestion of a bismuth meal, with the result that we believe the tumor mass to be the right kidney, which has moved a considerable distance from its normal position and become fixed there as a result of inflammatory adhesions, and is producing interference with the intestinal current.

The normal kidney is not a fixed organ, but moves up and down on respiration, although usually this movement cannot be detected on palpation. Clinically, three stages of abnormal mobility of the kidney may be described: first, a palpable kidney is one the lower half or more of which can be definitely felt on deep inspiration; second, a movable kidney is one in which the examining hand can define the upper end of the organ, and can restrain it from returning to its old position during expiration; third, a floating kidney is one which can be moved freely about the abdomen in all directions, and even across the middle line in some cases.

Palpable kidney occurs in women in 85 per cent. of the cases, in men rarely. The fossa in which the kidney lies is more shallow and wider at its lower part in women than in men. The frequency of movable kidney among women varies greatly according to the statistics of different observers, that is, from 3 to 46 per cent. The majority of cases are observed between the twentieth and fortieth years of life. The condition has been observed in infants and among the aged. The right kidney is movable fifteen times as often as the left. Among women repeated pregnancies with the resulting flabby condition of the abdominal walls are often followed by movable kidney, sometimes alone, sometimes as a part of general enteroptosis. Movable kidney is also frequently found in slender, poorly nourished females of lax fiber, with long thoracic cavities, who have never borne children. Tight lacing has been given as a cause in the production of movable kidney, but it is frequently found among races who never wear constricting clothing about the waist. Violent muscular effort, as in falls, railroad accidents, etc., and blows from blunt objects, such that, if more violent, would produce rupture of the kidney, are direct causes in a number of cases; rapid emaciation with absorption of perinephritic fat is sometimes observed as a cause. Constipation is an important element in the production of movable kidney, and probably acts by the loaded cecum dragging upon the anterior layers of the perinephritic fascia, and thus displacing it forward.

Symptoms.—The symptoms produced by movable kidney are quite varied. It is important to bear in mind that in a large number of cases no symptoms occur, and frequently the movable kidney is discovered by accident. It follows, therefore, that every movable kidney does not require operation, but only in cases in which marked symptoms appear is operation indicated. The principal symptoms produced by movable kidney are: 1. Pain. 2. Digestive disturbances. 3. Changes in the urine and disturbances of the urinary apparatus. 4. Pressure symptoms on the duodenum and biliary passages, such as dilatation of the stomach, jaundice, appendicitis from congestion of the appendix caused by compression of the superior mesenteric vein between the head of the pancreas and the spinal vertebra by the displaced kidney (Edebohls). 5. Nervous symptoms—neurasthenia and hysteria.

Pain.—The pain produced by movable kidney varies. In some cases the patient comes under observation because she has observed a movable lump in the abdomen, which in handling is painful, the pain being often associated with nausea and vomiting. In other cases pain and vomiting bring the patient under observation, the doctor discovering the movable kidney. These attacks are sometimes known as "renal paroxysms" or as "Dietl's crises." They occur suddenly; the patient is seized with violent abdominal pain; nausea and vomiting usually follow; the patient may fall into a condition of collapse, with small thready pulse, coldness of the extremities, and clammy sweating. There may be a chill and high temperature. Upon physical examination the kidney is usually found to be palpably enlarged and quite tender to touch. If the condition has been one simply of kinking of the ureter, subsidence of the pain will be followed by a transient polyuria—the condition has been one of acute hydronephrosis. Frequently, however, the attack is caused by torsion of all the structures of the pedicle, producing thereby an intense venous congestion of the kidney and greatly increased intracapsular tension. These attacks usually last longer, and reduction is not followed by so rapid a return to normal as in the former group of cases. In the large majority of cases of movable kidney no such severe attacks occur; the patient may suffer from moderately severe attacks of pain in the loin, in the sacral region, from neuralgic pains radiating into the lower extremities, from a sense of dragging and weight in the abdomen and back, made worse by the erect posture and by exercise. Such sensations may be more or less constant while the patient is up and about, but usually subside after lying in bed for some hours. During menstruation the pain is worse, and this condition often appears to be a determining factor in the production of an unusually severe attack.

Digestive Disturbances.—Nausea and vomiting usually occur either with the attacks of pain or independently of them. Constipation is the rule; occasionally, however, diarrhea occurs.

Changes in the Urine.—The urine remains normal in most cases of movable kidney; transient albuminuria or even the presence of a small amount of blood in the urine may appear during or following an attack. Frequent and painful urination are quite common. Polyuria is often observed at the end of an attack. Oliguria, anuria, and symptoms of uremia have been observed. Repeated attacks may lead to gradual dilatation of the renal pelvis and chronic hydronephrosis.

Pressure Symptoms.—Movable kidney may, by traction, cause partial constriction of the duodenum, gastric dilatation, and probably obstruction of the common bile-duct. Previous mention has been made of the mechanism whereby the congestion of the vermiform appendix and a predisposition to appendicitis may occur.

Nervous Symptoms.—One of the most common accompaniments of those cases of movable kidney presenting symptoms is a condition of neurasthenia, more or less profound, often associated with hysteria. In some of these cases fixation of the kidney by operation gives relief from these nervous symptoms, but many patients remain as neurasthenic as before. If the patient was neurasthenic previous to the appearance of symptoms referable to the kidney, operation will not be productive of much benefit. Many of these patients are apt to acquire the surgical operation habit, and go from one operator to another, having the kidney fixed, the appendix, the ovaries, and even the uterus removed, and in the end are no better, and may subsequently have several more operations for postoperative adhesions, ventral hernia, etc.

Floating kidney itself is rarely mistaken, but many other conditions have been taken for it. Distended gall-bladders, fecal masses in the colon, omental cysts, tumors of the pancreas, carcinoma of the pylorus, ovarian cysts, floating spleen, and many others have been diagnosed as such, and in some instances the mistake was not apparent until the abdomen had been opened. Even when the tumor is superficial it is easy to be misled by a vague resemblance in shape; when it is deep and scarcely movable there may be nothing but the peculiar character of the renal pain to serve as a guide.

Considering all these manifestations associated with the condition of movable kidney, what can be said as to the indications for operation? The following indications are, I believe, fairly safe guides: 1. Extreme mobility, so that the organ cannot be fixed by a support. 2. Extreme tenderness, so that a support cannot be tolerated. 3. The recurrence of acute attacks of pain and vomiting (Dietl's crises). 4. Persistent discomfort in the loin, combined with digestive disturbances, vomiting, and a great variety of neurasthenic manifestations; as a rule a kidney sufficiently mobile to produce such symptoms is tender to the touch, and examination causes pain and nausea. 5. The supervention of hydronephrosis or pyelitis. 6. Cases in which the kidney has become fixed in an abnormal position as a result of inflammatory adhesions, and producing obstructive symptoms, as illustrated in this present case.

Nephrorrhaphy or nephropexy is the name applied to the operation for suspending or fixing the kidney. The aim of the operation is to re-establish the kidney in as near its anatomic position as possible, so that with the healing of the wound the resulting adhesions and scar tissue will maintain the new support.

Operation.—The kidney may be exposed by either the vertical, transverse, or lumbar oblique incision. In the present case I will make use of the oblique lumbar incision, as I believe it to be the best. Beginning at the outer edge of the erector spinæ, on a level with the twelfth rib, the incision, about 4 inches in length, is carried downward and forward to a point a fingerbreadth above the highest point of the iliac crest. The incision is deepened through the first muscle plane, latissimus dorsi above and external oblique below, then through the second muscle plane of internal oblique. The aponeurosis of the transversalis and its muscle-fibers toward the anterior end of the wound are next incised from a point slightly below the upper end of the wound. The extension of the wound at this end may more carefully be accomplished by inserting the finger beneath the aponeurosis and carrying the incision upward over the guiding finger, thus avoiding a blind incision with possible injury to the pleura. The iliohypogastric and ilio-inguinal nerves are now held by the retractor with the posterior sectioned muscles, and the twelfth intercostal with the anterior. The transversalis fascia is now incised and the perirenal fat lies exposed in the wound. It is well to remember to incise this fascia first in the posterior part of the wound, and then to prolong the incision with the finger beneath as a guide. By following this procedure the danger of opening the peritoneum may be avoided.

The perirenal fat is now torn through and the upper pole of the kidney is exposed. The kidney lies at the lower part of the wound and toward the median line anteriorly. A careful separation of the remainder of the fatty capsule and the adhesions holding the kidney must be made before the kidney can be delivered into the wound. Having delivered the kidney, careful examination is now made for possible stone, or any abnormality, before proceeding further with the operation. The kidney is normal in size and there is no apparent pathologic change present, consequently we will proceed with the nephrorrhaphy. There are many methods of doing this, from the older way of leaving the wound down to the kidney open and packing with gauze, so that healing occurs by granulation, to the various methods of placing sutures through the kidney substance, or utilizing its fibrous capsule in different ways to suspend the organ.

The method which I usually follow, and will use in this case, is similar to the operation described by Edebohls and Albarran, with some slight modifications. The fibrous capsule is incised on a grooved director, along the convex border of the organ. By blunt dissection with the handle of the scalpel or the finger the

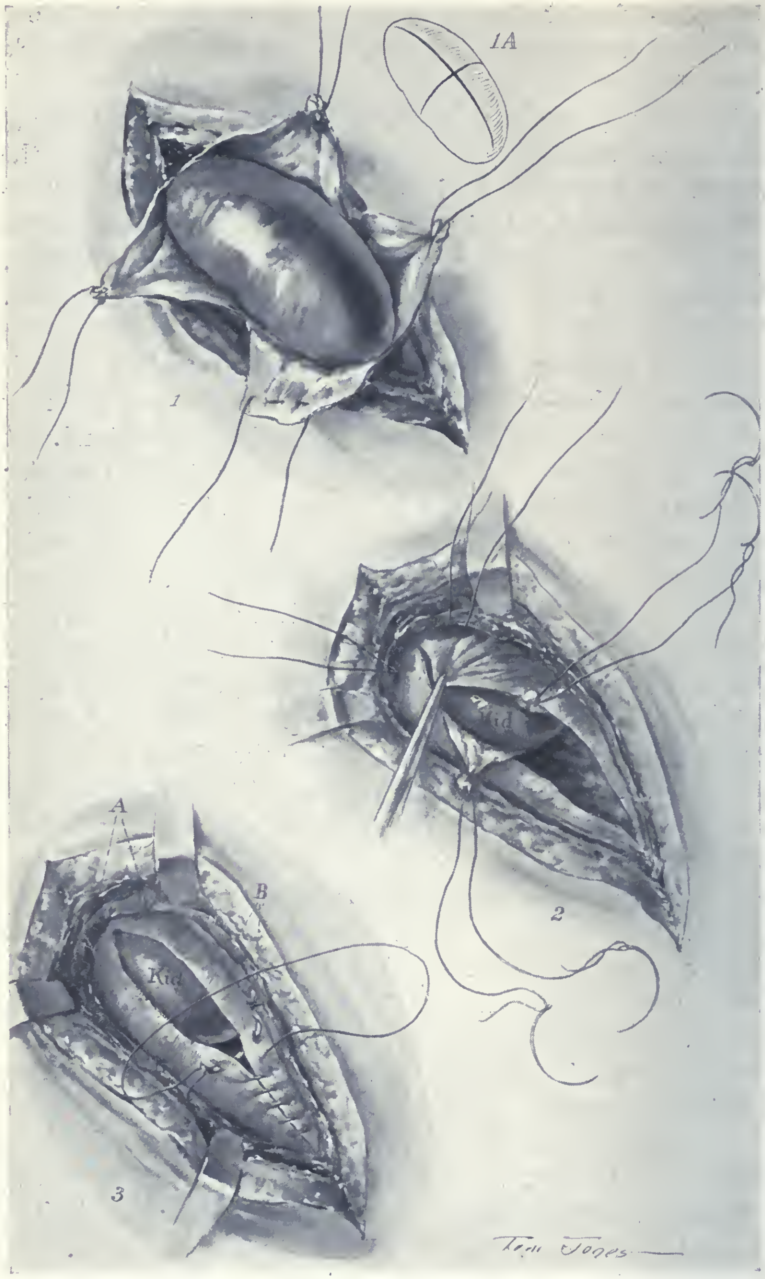

Fig. 346.

capsule is stripped back on either side, in two flaps, for a distance of $\frac{3}{4}$ inch. This exposes the parenchyma, from which there is a little oozing. This oozing is readily controlled by pressure with a gauze sponge. The fibrous capsule on either side is now cut through the middle, making of it four flaps, an upper and lower on each side (Fig. 346, 1*A*). The gathered end of each flap is now caught with a chromic catgut ligature, the ends of which are left long (Fig. 346, 1). The ligature of the upper anterior flap is now threaded on a needle, which is passed through the fascial layers at the upper angle of the wound; the other half of the ligature is now threaded on the needle and passed through the fascial layers about $\frac{3}{8}$ inch from its other half. The same procedure is now carried out with the upper posterior flap ligature (Fig. 346, 2). The two upper flap ligatures are now tied by my assistant, while I hold the kidney in its new position. This brings the kidney up under the ribs to about one-third its extent. The ligatures of the two lower flaps are now threaded on the needle, and the same procedure followed as was done with the upper flap ligatures. The wound will now be closed in layers with chromic catgut sutures (Fig. 346, 3), the transversalis fascia first, the aponeurosis and muscular layers next, and finally the skin, with interrupted silkworm-gut sutures. A large dressing is placed over the wound and a pad on the anterior abdominal side to aid in the support of the kidney, and a well-fitting abdominal bandage applied. The patient will be put to bed, with the foot of the bed slightly elevated, and a soft pillow will be placed beneath the scapula and buttock of the right side. This will keep pressure from the wound; and the position, with the foot of the bed elevated, will tend to obviate any possible tension on the suspending sutures. This position will be maintained with a little relaxation for about three weeks, after which the

Fig. 346.—1*A*, Line of incision of fibrous capsule of kidney. 1, Kidney delivered, flaps made and sutures inserted in flaps. Suture on lowermost flap is in position but not tied. 2, Sutures of two upper flaps passed through the transversalis, fascia, and muscle plane. Lower sutures threaded ready to pass through muscle plane and fascia. 3*A*, Upper suspension sutures tied and cut. 3*B*, Lower suspension sutures. Transversalis fascia being closed by continuous chromic gut suture.

patient will be allowed to sit up a little at a time for another week, giving at least one month before the patient is up and about.

During convalescence the patient should be fed on a diet that will tend to increase the intra-abdominal and perirenal fat, so that the support of these may be gained as an accessory to the operative suspension. These patients, as a rule, are more or less debilitated, and should be given plenty of time to recuperate before attempting to move about very much.

OLD UNTREATED FRACTURE OF EXTERNAL CONDYLE OF HUMERUS—FACTORS INFLUENCING CHOICE OF TREATMENT

This man is twenty-two years of age. He comes to us with the history of having received an injury to his right elbow when he was five years of age. He states that the injury was produced by a fall upon the elbow, and was considered as a dislocation and treated as such. A few weeks following the injury he says that a man was lifting him by the hands and the dislocation recurred, and was treated as before. From all we can learn from the patient there was not much made of the injury nor a great deal of care given to it. His surroundings were very poor and no doubt he received scant medical attention. The boy grew up to manhood without anything further being done for him. He says that he played baseball and took part in other sports, but when he exercised upon the horizontal bars his elbow would sometimes pain him a little. Last summer during his vacation he was employed as a freight handler in one of the local freight houses, and he says that he was able to perform his duties very well.

From the history given by the patient there is apparently a good functional result following the injury, but he wants to know if something more can be done for him. Upon examination the arm and forearm are found to correspond in size, both as to length and development, with its opposite fellow. The angle of the forearm to the arm has not been appreciably changed. Supination is not interfered with, but pronation is to a moderate degree. Flexion and extension are very good, in fact, almost complete. At the outer side of the elbow-joint and on the anterior surface there is an enlargement about $1\frac{1}{2}$ x 1 inches, which moves when the forearm is flexed and extended. It gives to the examining hand a sensation resembling that produced by the ends of bones rubbing together. When the forearm is flexed there is apparently a separation between this enlargement and the head of the radius, but this is not so distinct when the forearm is extended. The radial head seems to be attached to the enlargement. When the radius is rotated the enlargement does not move, but remains stationary.

As a result of the examination a probable diagnosis of fracture with displacement of the external condyle of the humerus is made; the good functional result, in a case of so many years' standing, is not unusual. Mr. J. B. Zingrone, our radiologist, has made some beautiful stereo-x-ray plates of this case, and by examining them you can see the true condition of the joint. There is no question regarding the condition after looking at these x-ray plates. The external condyle of the humerus has been fractured and displaced, carrying with it the radial head articulation. The condyle is attached to the humerus in some

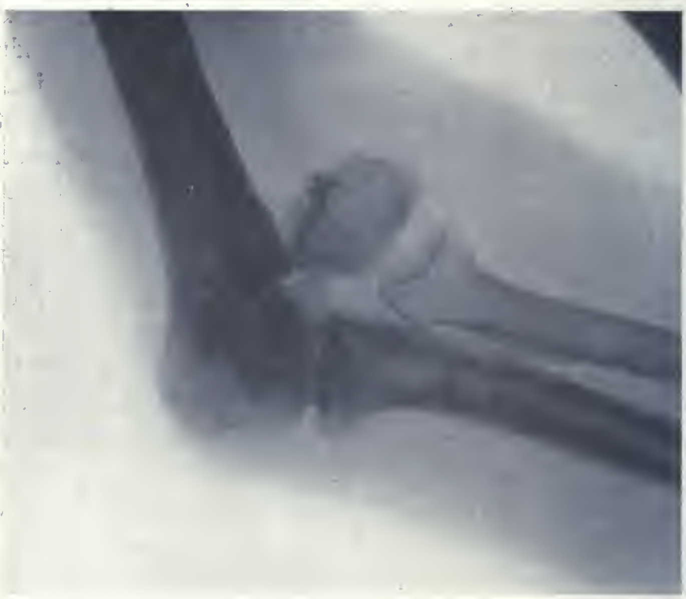

Fig. 347.—x-Ray of elbow seventeen years after injury. Note that entire external condyle has been separated from the humerus carrying with it the radial articulation.

way by fibrous tissue, which allows of certain movements of the condyle, and at the same time does not interfere greatly with the function of the joint (Fig. 347).

While speaking of this case I wish to impress upon you the great value of stero-*x*-ray plates in all joint injuries. The information gained by this method of examination so far surpasses the single plate that I am sure if you once use this method you will be convinced of its superiority.

What to do for this young man is a question. Of course, if this were a recent case and the displaced fragment of bone could not be retained in proper position by flexion of the forearm and the application of an angular splint, then an open operation would be indicated and the displaced fragment of bone secured in position by wire, screw, or nail. But, according to the history, this injury is now of seventeen years' standing, and the functional result is good; there is no pain or discomfort and practically no inconvenience to the patient. His occupation (theological student) will not require any very violent manual labor, hence he is not in a very bad way. On the other hand, the operative risk that he would take, especially in regard to the movements of the joint, have been explained to him, that he may make his own choice, whether to continue as he has or have the bone replaced and fixed by operation. The case looks quite simple, and under ordinary conditions there should be no great difficulty in performing the operation and obtaining a good result, but I would warn you that previous to proceeding with your operative measures in a case of this long standing, with such a good functional result, to explain to the patient the possibilities that might occur and let him decide for himself.

GREENSTICK FRACTURE OF TIBIA

This school-boy, aged thirteen years, while engaged in playing a game of baseball, attempted to steal second base, and in making his jump for a slide he says that his spikes became caught in some manner and his right leg was given a severe twist. He suffered a great deal of pain and did not attempt to arise or stand upon the injured limb. The trainer in charge of the boys immediately applied a bandage to the injured limb and the patient was transported to the hospital. An examination was made of the limb at this time and it revealed no apparent deformity, but upon very gentle manipulation crepitus could be determined. In view of the fact that there was no apparent deformity, no further manipulation was allowed, but the patient was sent to the *x*-ray department in order that *x*-ray plates might be made at once. The *x*-ray plates show very clearly the nature of the injury—evidently a greenstick fracture of the tibia without displacement. The fibula is not fractured and there is no apparent deformity (Figs. 348, *a* and 348, *b*).

This fracture of the tibia was produced, no doubt, by the twisting of the limb, the lower part of the limb being firmly fixed by the spikes of the shoe having been driven into the ground, and the body acting as a lever. In cases such as this, without deformity, it is not good policy to manipulate the limb to determine the site of fracture, if any, but rather have an *x*-ray plate made at once and be guided by it.

It is quite evident that considerable damage could be done in a case of this kind by manipulation. The sharp points at the lower or upper end of the fracture could very easily be made to pierce the soft parts, thereby changing the simple into a compound fracture.

In the treatment all that is necessary is the application of some form of a light retentive dressing merely to overcome movements. The various forms of metallic splints conforming to the shape of the limb may be used, or a well-padded wooden splint. Personally, I favor the use of a light plaster-of-Paris cast, and that is the form of dressing that will be applied in this case. In applying a plaster-of-Paris cast be sure that it is well and evenly padded and that there is no undue pressure made on any

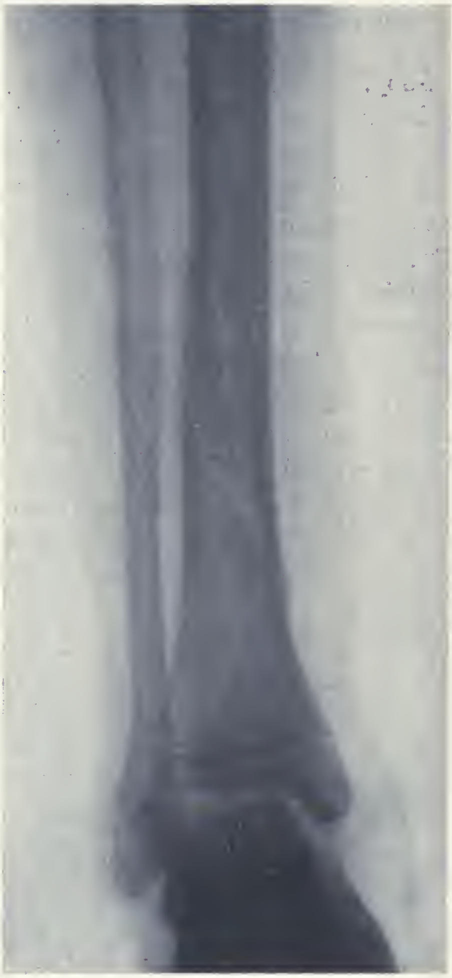

Fig. 348, *a*.—Anteroposterior *x*-ray picture of leg, showing greenstick fracture of tibia.

point. Never apply a cast too tightly. If there is any question in your mind that the cast is too tight, split it through the center and afterward hold it in place by a bandage. This patient will wear the cast for three weeks, after which time he will be allowed to use the limb, with the aid of crutches. In a short time, as soon as the patient feels sure of the limb carrying the body weight, the crutches will be discarded, and a cane or walking stick substituted if necessary.

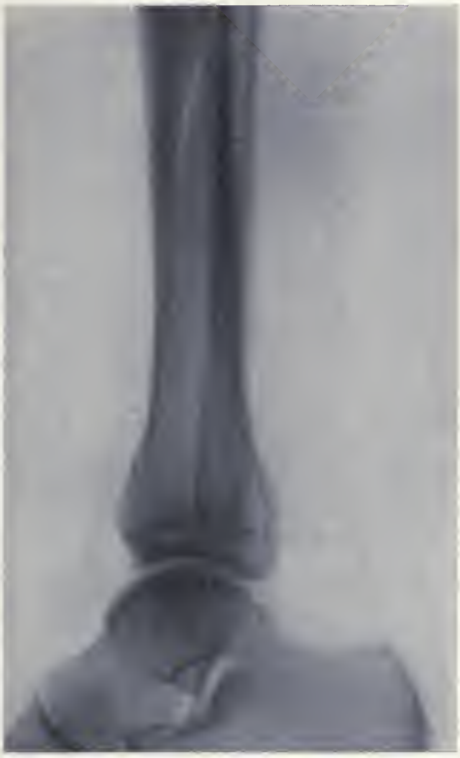

Fig. 348, *b*.—Lateral *x*-ray picture of leg, showing greenstick fracture of tibia.

CLINIC OF DR. EDWARD H. OCHSNER

Augustana Hospital

TECHNIC OF ABDOMINAL SECTION

Summary: Laparotomy for adnexal disease; preparation of field of operation; scrubbing with soap and water followed by alcohol the best method as a rule; abdominal exploration; removal of left adnexa; "temporary ventrosuspension of the uterus"; closure of abdominal incision.

April 23, 1919.

The patient is a female, thirty-six years old; her mother died with cancer, otherwise the family history is negative. On various occasions during the past three years she has had slight pain in the right side about the region of McBurney's point, and just one month ago she complained of very severe pain in the left lower quadrant of the abdomen. Up to three months ago the menstruations have been normal and painless, but during the last three periods she has had extreme pain in the left side and the flow has persisted for seven days instead of four days, as previously. On examination one month ago, shortly after her menstrual period, the left tube was distinctly palpable and very tender. Two weeks later the tenderness had almost entirely subsided, but during the last menstruation the pain was again severe, and since then the tenderness and pain have persisted.

Physical Examination.—The patient is a rather nervous, fairly well-nourished, slightly anemic woman; heart and lungs normal, abdomen scaphoid, slight tenderness over McBurney's point, more tenderness in left inguinal region. The perineum is intact, the cervix also; the uterus is far down in the pelvis; the right adnexa are palpable and not tender. The uterus is drawn slightly to the left and is immovable. The left adnexa consist of a firm, egg-sized, immovable, tender mass.

Operation.—You observe that, except for the shaving, which was done yesterday evening, we prepare the patient on the table immediately preceding the operation. We scrub the abdomen carefully with sterile soap and sterile water and finally with 95 per cent. alcohol. After many years I have found this method to be by far the best. The great danger in preparing the patient the night before is that the irritation from the shaving and antiseptic used will cause a slight itching and the patient during the hours of sleep is apt unconsciously to get her hand under the dressing and thus contaminate the field of operation. The following morning the surgeon begins his operation with a false feeling of security. If the preparation of the patient is made on the table directly before the operation under the supervision of the surgeon this danger is avoided and antispetics are entirely unnecessary, and I think even harmful, because they cause skin irritation and because they are apt to divert the attention from an essential to a non-essential. That antiseptics are undesirable and unnecessary I have proved to my own satisfaction. From January 1, 1908, to July 1, 1910, a period of thirty months, I made accurate observations on every clean operation that I performed, and during that period I had only two stitch infections. One was in a right rectus incision for gall-bladder and appendix in which a spurter struck my glasses and a drop fell back into the wound. This wound was slightly infected, but was entirely healed within two weeks. Another, in a McBurney's incision for recurrent appendicitis, in which, by some error in technic, one of the catgut stitches became infected and from which there was a discharge in the course of a few days of not to exceed 2 drams. These were absolutely the only infected clean wounds that occurred in a period of thirty months, and that, without the use of a single antiseptic, certainly a record that it would be difficult to duplicate where antiseptics are used. I firmly believe that antiseptics are not only useless, but actually harmful, because they result in misplaced confidence, and if one's attention is centered on a non-essential it is likely to be distracted from the essential.

We now make a low median incision, picking up the peritoneum with great care so as not to injure the intra-abdominal organs. I pass my right hand up under the liver and carefully examine the gall-bladder. It is moderately filled, but collapsible, and contains no palpable stones. I now draw the cecum up and make a careful examination of the appendix. It is found with difficulty because it is completely embedded in old adhesions. These we loosen, I remove the appendix, and bury the stump in the ordinary manner, being very careful to leave a smooth surface. We now lower the head of the table, pack the small intestine, cecum, and omentum away from the field of operation with a large dry sterile gauze pad, then carefully examine the right tube and ovary, which are normal. The ovary contains a large false corpus luteum, which we do not disturb. The left adnexa are embedded in a mass of adhesions, to the right we find the uterus, posteriorly the sigmoid, which, with the tube and ovary, make a mass about the size of a small lemon. We find the point of cleavage, clamp the tube and broad ligament on the mesial side from the mass, and the broad ligament on the lateral side, and remove the mass, consisting of inflamed ovary and tube, ligate the stumps, then bring the two stumps together with an unchromicized catgut stitch in order that the opportunity for adhesions may be reduced to the minimum. We place the sigmoid in its natural position and observe the position of the uterus, which we find drops back into the pelvis.

For the past seventeen years I have used an operation in this class of cases to prevent the uterus from falling back into the pelvis, becoming adherent in this position, and making a plug to the pelvic outlet. I called the operation "temporary ventrosuspension of the uterus," and it is performed in the following manner: A strong cervix needle armed with unchromicized catgut is introduced through the rectus fascia on the left side about one inch below the lower angle of the peritoneal wound, passed through the rectus muscle, and then through the peritoneum. Then a good bite is taken of the uterus a little behind the top of the fundus of the uterus, and the needle is brought out in the reverse order on the right side, and the stitch tied just tight enough to hold the uterus in apposition to the

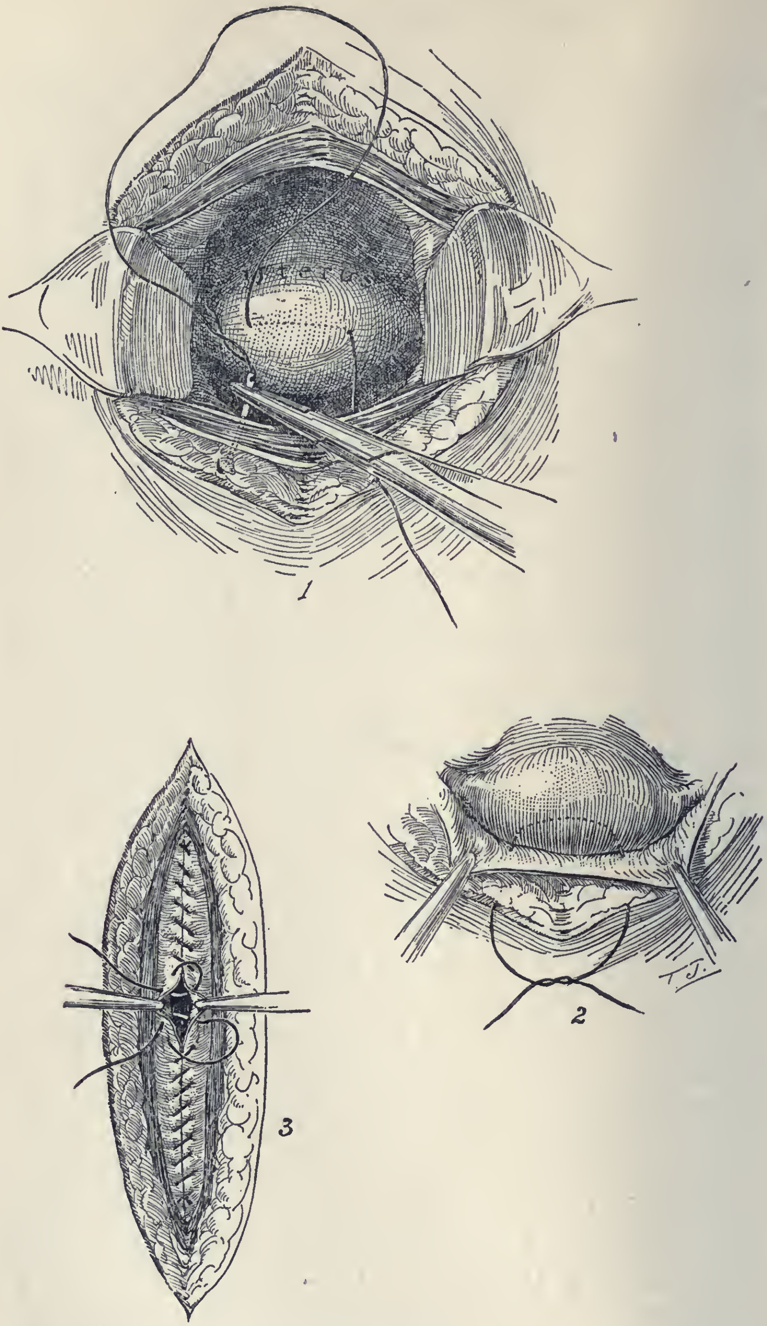

Fig. 349.

uninjured parietal peritoneum. The sigmoid is now brought around behind the uterus in its normal curve, all the abraded surfaces covered with omentum. In the past seventeen years I have used this method in all my cases of pelvic infection in which the uterus showed a tendency to fall back in the pelvis, have followed most of my cases carefully, and have found that this is an effective method of preventing postoperative retroflexion with its concomitant constipation and digestive disturbances (Fig. 349, 1, 2).

Now that the peritoneal toilet is completed, we will proceed to close the abdominal wound. First we use silkworm-gut stitches in the ordinary manner, passing them through skin, fascia, and muscle. We then close the peritoneum, but here we make a slight variation from the usual method, namely, we close it in from both angles, ending the closure at about the center. Then after removing the last abdominal pad we raise the peritoneum with these hemostats and tie the two catgut stitches together while the peritoneum is thus raised (Fig. 349, 3). By following this procedure I am sure we are able to very materially reduce the percentage of cases which subsequently suffered from adhesions. I have now used this method for something like fifteen years, and during that time have been surprised by the rarity with which patients complain of intra-abdominal pain even after the most extensive operations. We now close the fascia from both angles in the same manner. This, I believe, is a precaution worth taking and one which materially reduces the percentage of postoperative hernias, because by beginning at the angles one is sure to catch the fascia with the first stitch, while, if one ends at one angle, this is not always so easily accomplished, particularly in very obese patients. We now close the skin wound with horse-hair stitches, securing careful coaptation, and then tie the silkworm-gut stitches loosely. The silkworm-gut stitches are employed simply as a matter of

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Fig. 349.—1, 2, "Temporary ventrosuspension of uterus" by a single stitch of chromicized catgut. 3, Closure of peritoneum; the suturing is begun at each angle and terminates at the middle of the incision, permitting eversion of the peritoneal flaps.

insurance to protect the patient from the calamity of having the abdominal wound split open anywhere between the fourth and tenth day, and are left in place for thirteen days even if the patient is permitted to get up before that time.

Catgut prepared even by the same firm often varies greatly in the number of days it takes to become absorbed, and I now know of a considerable number of patients in the hands of a number of operators in whom the abdominal wound split open, either because no silkworm-gut stitches were employed or because they were removed too soon. This unfortunate accident can be avoided in practically every case if the silkworm-gut stitches are used, tied loosely, so as not to shut off the blood supply, and if they are left in a sufficient length of time.

OLD OSTEOMYELITIS OF THE TIBIA

Summary: Extensive osteomyelitis of tibia of seven months' duration; radical operation for cure; the postoperative dressings; treatment of pyocyaneous infection; Unna's paint as a plug for the bone cavity; method of preparation of the paint; final result.

THIS case, a boy sixteen years of age, came to us on March 11, 1919, with a history that about three years ago he had a number of boils on his neck. Last summer he had two on his arm. September, 1918, after playing football, he experienced pain in the ankle. This was followed in a couple of days by chills and pyrexia up to 104° F. Ankle and lower portion of leg were markedly swollen, red, painful, and tender. This was incised and considerable pus discharged. Three weeks later he was operated under an anesthetic and the bone scraped.

On admission to the hospital March 11, 1919, the patient was poorly nourished, the face was covered with acne, and there was numbness and weakness of right arm, apparently due to long-continued use of crutches. Heart, lungs, and abdomen negative. Right lower extremity from the knee down considerably atrophied, with swelling of the ankle and the foot at rest held at an angle of 105 degrees. Dorsal flexion, both active and passive, about 5 degrees, extension about 10 degrees, both causing some pain. On the anterior surface of the shin from 2 inches below the anterior spine of the tibia to the ankle was a linear, depressed, reddened, inflamed scar with numerous sinuses discharging pus. From the lowermost one there was projecting a piece of gauze, which, on removal, left a cavity about 2 inches deep.

After applying an Esmarch we opened the old scar the full length, and reflected skin and periosteum on either side, being careful not to separate the skin from the periosteum. We opened into the marrow space of the tibia from one end of the infected area to the other, removed a number of sequestra, then chiseled away as much of the sides of the trough as seemed safe without running the risk of getting a fracture of

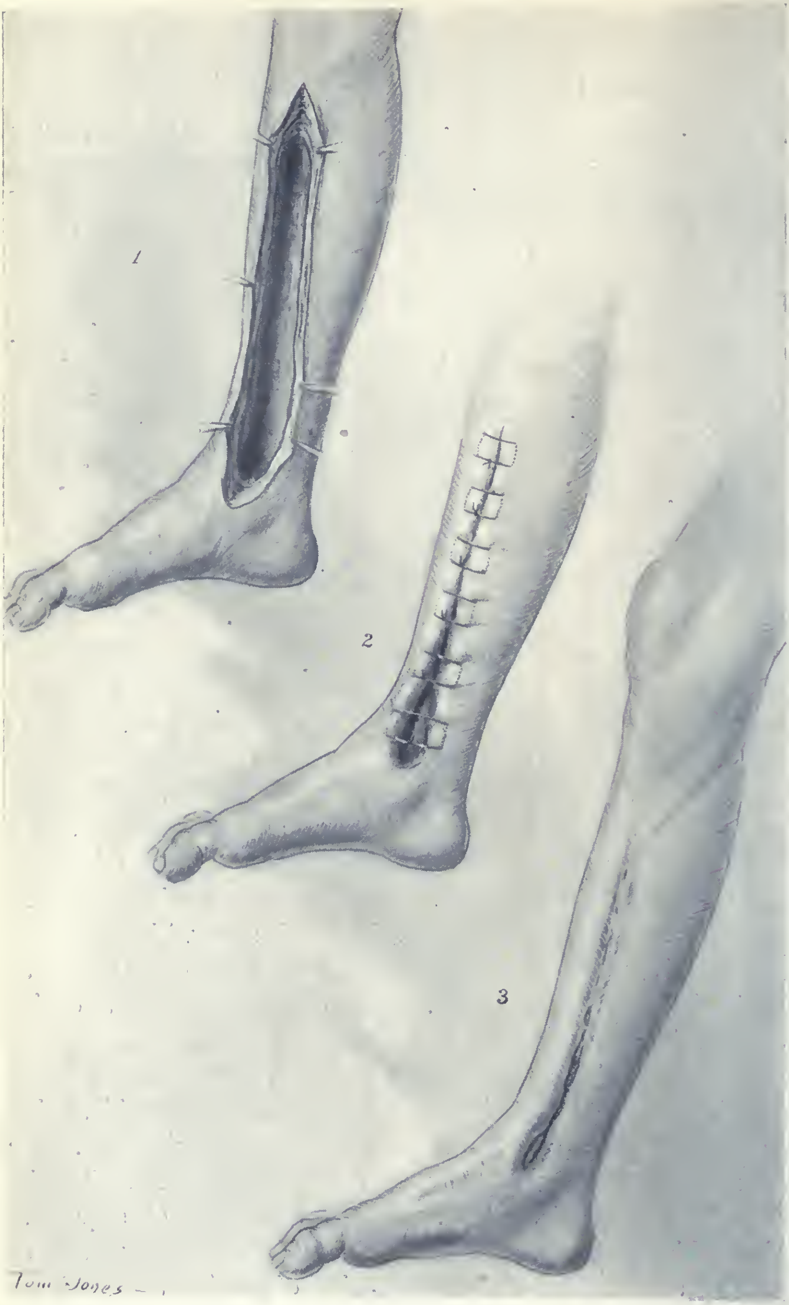

Fig. 350.

the tibia (Fig. 350, 1). At the lower half it appeared to be unsafe to remove much of these sides because the posterior surface of the tibia had necrosed through to the periosteum. Skin and periosteal flaps were now made to cover the denuded tibia loosely by infolding (Fig. 350, 2). The lower half of the wound where the skin and periosteal flaps were not sufficient to cover was packed lightly with sterile gauze. Dry dressing applied.

Postoperative History.—Moderate bloody discharge persisted for the first twenty-four hours without much pain or pyrexia. Two days after operation the wound was redressed in the same manner. On the fourth day after operation the wound was again dressed; the pussy discharge was quite profuse, greenish in color, with the characteristic pyocyaneous odor. The wound was cleaned, the cavity filled with 1 per cent. acetic acid in normal salt solution, as advised by Taylor for the treatment of pyocyaneous infection, and then packed with gauze saturated in this same solution. Dry dressing applied. This dressing was continued daily for ten days. After the very first dressing the green pus became very much less in quantity and at the end of ten days no further trace of it was visible. The wound was at that time covered by strong, healthy, red, firm granulations. The silkworm-gut stitches were removed and the upper half of the wound was, with the exception of one pea-sized spot, completely healed. The lower portion of the wound was now filled with sterile Unna's paint at 45° C. or 113° F. Since that time the patient has been placed in a full bath at 93° F. every second morning and the cavity filled with Unna's paint covered with a dry dressing, and the defect has filled in with surprising rapidity. Figure 350, 1 shows the appearance of the leg at the end of the operation. Figure 350, 3 shows the appearance of the leg forty-three days after the operation or twenty-nine days after the beginning of the use of Unna's paint.

Fig. 350.—1, All necrotic tissue and exuberant granulations removed and the bone cavity converted into a wide gutter. 2, Soft tissues carried into gutter by mattress sutures, thus obliterating all but the lower portion of the cavity; here the soft tissues are too scant to cover the osseous defect. 3, Result after twelve weeks.

I have found this method of treating osteomyelitis of the long bones much more satisfactory than any other, even including the Moorhof wax plug. It is truly surprising to see with what rapidity these wounds fill in and heal out completely. There are only two precautions necessary. One is that properly made Unna's paint be used, and the other that it be employed at the right temperature. The temperature sense of the surgeon is scarcely sufficient in determining the proper temperature of the melted mixture. The temperature must actually be regulated by a dependable thermometer and should be about 45° C. Unna's paint should be made in the following manner:

Take a double boiler (ordinary oatmeal boiler), fill the outer basin one-third full of ordinary water, then place 10 ounces of sterile water in the inner boiler and 4 ounces of ordinary grocer's sheet gelatin. Place inner receptacle in outer receptacle and put over a slow fire, leaving it on until gelatin is dissolved, then add 10 ounces of glycerin, and then 4 ounces of zinc oxid gradually, constantly stirring.

When completed, Unna's paint is placed in a sterile Mason jar, this set in some cold water on some gauze or a towel, the water nearly up to the rim of the Mason jar, with the cover placed loosely over the top of the jar, and boiled for an hour, thus sterilizing the mixture.

Whenever Unna's paint is required, place the Mason jar in some cold water on a piece of gauze and heat until dissolved. Pour some in a sterile cup, test the temperature, and when 45° C., fill the cavity with the preparation. Then apply a dry dressing. In two days have the patient take a tub-bath at 93° F. for fifteen minutes, then re-apply the dressing, and change it at forty-eight-hour intervals until the wound has healed.

On looking at the illustrations it will be observed that the foot is held at an angle of about 105 degrees to the leg. It was in this position when the patient first came under my care, with very little motion possible at the ankle. So much of the lower end of the shaft of the tibia had to be sacrificed that it was impossible to bring the foot to less than a right angle without risk of fracturing the tibia. Consequently, no effort was made at that time to correct the deformity. In acute osteomyelitis of the shafts of long bones great effort should be made to prevent faulty positions of the nearest joints. Because drop-ankle was not prevented in this case it may be necessary to anesthetize this patient again in order to correct this deformity.

There is still another criticism which I wish to make in the previous treatment of this case, namely, that the second operation was done too soon after the onset of the disease. While the first incision of the periosteum with a possible opening into the medullary canal should be done just as soon as a diagnosis is made, the secondary operation should never be performed until one is convinced that the sequestrum has entirely loosened and the involucrum has become strong enough to prevent pathologic fracture. In an acute osteomyelitis of the tibia at least two months should intervene between the onset of the disease and the sequestrotomy.

Postscript.—The wound became completely healed on June 3d, exactly twelve weeks after the day of the last operation, with the deepest point in the trough only $\frac{5}{8}$ inch below the level of the surrounding tissues.

CLINIC OF DR. KELLOGG SPEED

Cook County Hospital

ELEMENTARY AND APPLIED PHYSICS OF BONE

Summary: Mechanical factors which influence the behavior of bone from the standpoint of its physical structure; the relation of local trauma and systemic disease and the application of Wolff's law; the physics of fractures.

To practice surgery correctly, particularly in those branches dealing with bone-structure, we must have an elementary knowledge of osseous structure from a purely physical standpoint. Bone, although in a physical sense the hardest structure in the human body, must not be considered an inert and completely rigid framework on which the organs and tissues are draped. It possesses properties of elasticity and toughness which are essential to its contour and which resist stress and strain. Bone structure is consequently governed by the same physical laws as other elastic substances subjected to stress and strain. Let us then consider bone from the physical standpoint; and we may profit by dividing this subject into the following headings:

1. The physical structure of bone.
2. The relation of the pathologic changes affecting the physical structure, as found in local trauma, such as fracture, and in systemic disease.
3. A discussion of Wolff's law.
4. The application of these points to the general mechanism of the commonest lesion of bone, which is fracture.

1. *The Physical Structure of Bone.*—As an illustration of the physical structure of bone and its adaptation to natural needs, let us take the calcaneus. The heel bone acts as a weight breaker between the body and the ground, and also it is the

anchor into which is inserted for leverage action the powerful group of calf muscles. It is very accessible and its size permits a complete study of its physical architecture, deductions from which can be applied to all bones.

The construction system of this bone has been well understood since 1903, when its great strength was found to depend upon two trabecular or truss systems (Fig. 351). One of these systems converges toward the center of the bone and acts as a truss which bears the force offered by compression violence, such as in weight-bearing. The other trabecular system arches across the long axis of the bone from front backward and acts as a truss which resists the pull of the plantar and calf muscles.

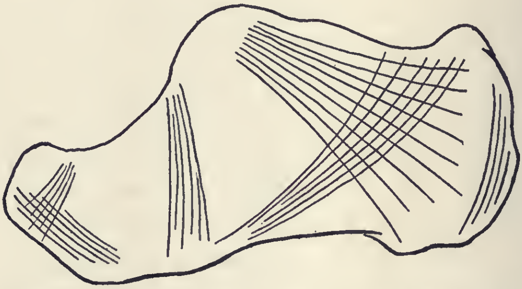

Fig. 351.—The trabecular system of the os calcis, showing truss rod supports by means of which the bone adapts itself to both compression and tensile forces.

The calcaneus we know must bear enormous strain and compression. It has been demonstrated that it requires a force varying from 150 to 950 kilograms to crunch this bone, and that to cause a cracking break through the body frequently requires a force of from 50 to 200 kilograms. If the calcaneus withstands the numerous strains incident to human life, its physical architecture must be worth studying, because it is undoubtedly influenced by static conditions of stress and strain. We know that this bone anatomically is a spongy bone with truss-like trabeculæ crossing at the different angles which I have mentioned. The covering of the bone is an extremely thin shell of compact tissue, and therefore it is this spongy property which preserves the bone from crushing in the compression sustained in falls and the avulsion force of muscular action. Experimental and clinical observation lead us to the firm conclusion that the spongy structure of bone is more elastic and is intended to take up compression and tensile strains, and that the compacta, on the other hand, which figures largely in the shape and strength of the pipe-stem, or long bones, is intended to give rigidity and form. The cancellous ends of the long bones regardless of their apparently delicate structure will resist enormous pressures if these pressures are applied in the normal direction of the body weight or muscle pull.

These elementary physical points in osseous structure are well worth considering when we study fractures or traumatic bone lesions. We frequently consider that the shaft of a long bone, such as the tibia, is its strongest portion, but fracture study leads us rather to conclude that the cancellous ends of bones are stronger and offer greater resistance than pipe-stem bones with a heavy compacta.

2. *Certain Changes Occurring in Bones Following Local Trauma or Accompanying Systemic Conditions Which Have a Bearing on Osseous Structure.*—A qualitative analysis of bone from a physical standpoint demonstrates that its properties of hardness and rigidity are furnished by calcium phosphate, carbonate and fluorid, with the addition of some magnesium phosphate, and that practically 66 per cent. of the total weight of adult bone is composed of these salts. The bones of adolescents contain a smaller percentage of these salts; senile bones a greater percentage.

Roentgen ray study of bone structure has given us some knowledge of the relative salt content of bones and its variation under given conditions. We have come to learn that there exists in human bones a condition of *calcium equilibrium* or balance, much as there exists a protein equilibrium in other tissues of the body. It is understood that there is a continuous flow of calcium salts to and from bones, most of the variation in this flow depending on the calcium supplied by food intake and on the general body metabolic processes. This mechanism is so intricate that it is as yet not completely understood, but under ordinary food and metabolic conditions the supply of these salts is sufficient to meet all demands. However, when the diet is deprived of calcium salts which it needs, there is an absorption of these same salts from the bones. This loss first affects bones which can spare calcium best without dangerously diminishing their tensile strength, namely, the ribs, skull, and sternum. The amount of ingested calcium is not necessarily a measure of that used in physiologic bone reconstruction, because other tissues of the body demand these salts. In diseased conditions such as rickets and osteomalacia there is probably a *diversion* of the calcium salts to other structures of the body or an increase in their excretion through normal channels. We also know that there exists a *perversion* of the use of calcium salts, particularly in diseases of the pituitary body and in congenital absence of the thyroid or thymus, which leads to bony defects, enlargements, and perverted bone growths.

Bone, moreover, is a living and growing tissue, and must, as all such tissues are, be subjected to changes in size and shape from time to time. It is built up and torn down, much as skin and other tissues which are constantly undergoing growth, use, and repair. Its rigidity must vary from time to time and it is consequently shaped by the stress and strain it is subjected to, as well as the forces of local metabolism and trauma just the same as are the soft tissues of the body.

To apply these facts to surgery we must consider then that the rigidity and physical structure of bone is disturbed when its normal physiologic activities are interfered with. As an example, let us take injuries which interfere with the all-important blood supply of the bone; then these physiologic functions may be interrupted temporarily as much or more than they are in systemic disease. There is, however, no doubt that a proportion of these earthly salts in the bone matrix is a true indication of the life and activity of the bone, that is, both of its age and its condition of health. When a bone is diseased or injured or in any way deprived of its normal function of stress and strain from weight-bearing and muscular action, atrophy develops within it. In muscle we are familiar with a similar phenomenon, namely, atrophy of disuse, which leads to a smaller muscle belly, usually capable of coming back to normal size and strength when placed again under normal physiologic conditions. The proportion of salts in this injured or diseased location is disturbed and the first evidence of this disturbance is found in the character of the shadow cast on a plate by the Roentgen ray. We know that these salt elements throw a shadow on the *x*-ray plate in proportion to their atomic weight. Calcium, which has an atomic weight of 40, makes a denser shadow than magnesium with a weight of 24, and because the latter metal represents but a small proportion of the earthy salts in bone, the main rôle in the shadow density on the *x*-ray plate is played by the calcium salts. The truth of this statement is found in the fact that recent callus casts no shadow because no calcifying salts have been deposited. When a bone is fractured or seriously injured we expect, at least, a local disturbance of calcium equilibrium. It is found at the site of the trauma partly on account of the circulatory interference and partly because the new growth of bone needed to repair the defect caused by the fracture depends on the preliminary outgrowth of the capillary vessels. This capillary outgrowth must be preceded by a softening of the bone, and we find, therefore, a withdrawal of the stiffening calcium content locally, which is easily demonstrated by a roentgenogram.

3. *A Discussion of Wolff's Law.*—Some of these ideas concerning the physical structure of bone have been expressed as Wolff's law, which is as follows: "The structure of bone is determined by the internal reaction of the individual bone to the body weight and to the stress and strain of muscular activity." These forces govern its structure and shape. This law may be applied widely in bone traumata and diseases. It governs the formation of a large, firm mass of involucrum about a weaker sequestrum of osteomyelitic bone. The new disposition of bone trabeculæ and the laying down of calcium salts becomes very heavy and strong enough to build up the resistance about the weaker pieces of diseased bone and to assure the limb or part of its necessary

physical support. That point in protective bone development has to go back to the law that the shape of bone is determined by the conditions of body weight and stress. Bone weakened by infectious processes must be strengthened to bear weight, else it will fracture. We know that fractures do occur under these conditions, but we also know of the enormous effort put forth by nature to avoid these pathologic breaks in the building up of this necessary strengthening structure. The law governs also the changes which follow deformities of the bone after fracture. Many years after angular deformities occur and heal following shaft fractures we find them modified and repaired by the deposition of a new calcium matrix on the concave side of the angularities. The excess portion of callus on the convex side of the healed deformity is gradually absorbed until a new straight line is developed in the bone which meets the physiologic demands of weight-bearing and muscular stress. We must, therefore, attempt to replace fractures in a position nearly normal in regard to the functional activity of the bone involved, on account not only of well-accepted reasons, such as avoidance of deformity or to obtain equal length of the limbs, but also because we must consider that this nearly normal reposition involves less local reaction within the bone structure, inasmuch as it does not have to meet changed conditions of weight-bearing and muscular stress. If a malposition becomes united, we see that the local plastic building up and tearing down of callus continues until nature has established an axial replacement of the bone concerned which meets the physical requirements. This change may demand years of time to fulfil. Also we must consider that bone must thoroughly calcify and cement in position before it is subjected to strains and functional use which it cannot sustain. Should this precaution not be taken, we see secondary deformities. A weak callus gives a bending, a deformity, and a functional loss. A thickened callus means an angular deformity or a functional interference from pressure on blood-vessels, nerves, or tendons results. All of these changes are in accordance with Wolff's law of the physiologic activity of bone.

4. *The Application of These Points to the General Mechanism of the Commonest Lesion of Bone, Which is Fracture.*—Let us apply our knowledge of stress and strain to the general mechanism of fracture, which is the commonest lesion affecting bones. Any direct trauma suffered by the body results in stress transmitted to the body and the bones supporting the body, and these stresses can be divided into component compressive and tensile factors modified by various torsion, flexion and shearing stresses (Fig. 352). In addition to that simple analysis, where a fall or severe shock has existed, there are complicating vibrations and jars of the limb or body which may produce additional rapidly alternating compression and tension forces which may prohibit the simple mechanical analysis of any given break. The additional vibrations mentioned may break or modify the bone, when it is under a severe bending or torsional stress, almost to the point of giving way. The small vibrations may act as the last straw on the camel's back and cause a complete giving way of the osseous structure. Referring to the structure of the calcaneus, we can see that the truss-like structure of the bone, which is found in its cancellous portion, is designed to take up stress on account of its supporting character like the arches of a bridge. The hard, rigid, and form-producing com-

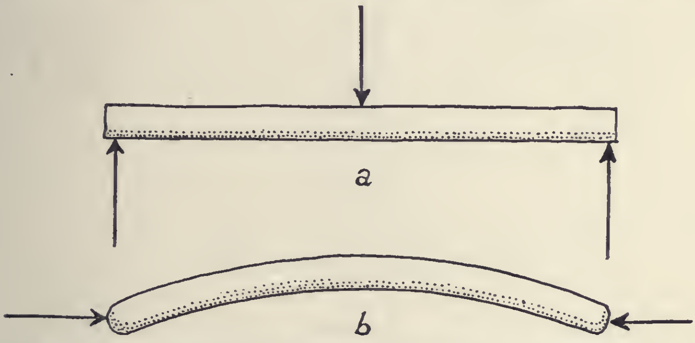

Fig. 352.—*a*, Illustration of direct compression force applied to a long bone, the ends of which are reasonably fixed. The end arrows indicate fixation of the joints at the ends of the shafts. *b*, Illustration of bending of the bone with flexion in its middle and beginning pressure in its long axis from body weight and muscle pull.

pacta which encloses the cancellous portion, giving shape and rigidity to the long bones, is not intended to act as a great force resister.

To simplify the study of fracture in long bones, let us consider that the principal forces which act on an extremity are either compression or torsion strains. Compression rarely acts at a direct right angle to the long axis of the bone, as in the leg, but usually with some obliquity. Where it does press against a long bone we have a compressive strain, and opposite to this point on the other side of the shaft of a long bone there is a corresponding point of maximum tensile force which endeavors to tear the bone apart (Fig. 353). We have thus two forces acting at the same time, one endeavoring to break the bone in by pressing upon the surface on the one side, and the other a transmitted force endeavoring to pull it apart and overcome this tensile adhesion on the opposite side. A physical analysis of these forces in osseous structure shows that a long bone tends to give way from a tensile force much sooner than from an equal compressive stress (Fig. 354), that is to say, the ratio varies as about 2 to 3, ordinary bone shaft being of such structure that it must yield to a tensile force which pulls it apart sooner than an equal compressive force which attempts to crush through it at a given point. Consequently, a compressive force must

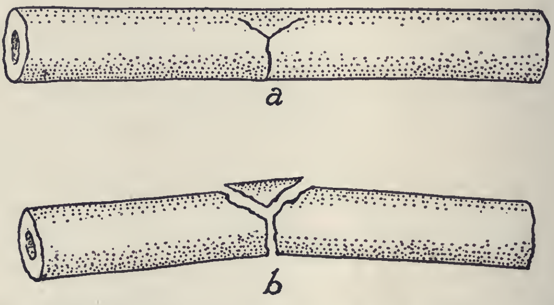

Fig. 353.—An example of compression force applied to a long bone in accordance with diagram in Fig. 352. The plane of separation starts at *a*, and the bone yields first from the tensile force opposite the point of compression, giving a more or less transverse fracture with breaking out of the fragments.

be greater to accomplish a fracture—as 3 to 2 compared to a tensile force which will tear the bone apart and produce a solution of continuity. It is not difficult to understand, then, that long bones giving way from tensile stress sooner than from compressive strain will be rarely fractured except in a transverse or oblique plane, because there is a progressive giving way of the structure of the bone as it bends in resistance to these two types of force. The divisional line of separation of osseous tissue develops just the same as in a steel beam subjected to bending compressive pressure (Figs. 355 and 356). Structurally these points have all been worked out in steel beams in our large

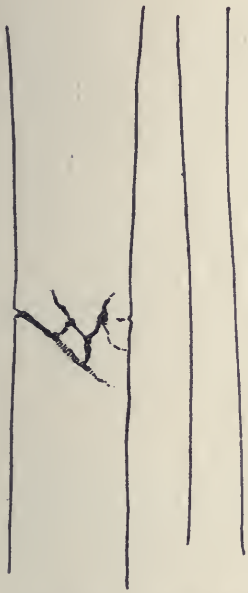

Fig. 354.—Tracing of a skiagram of an actual case illustrating the mechanism described in Fig. 353.

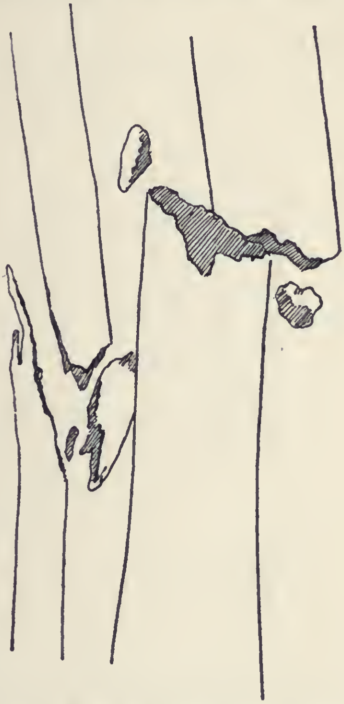

Fig. 355.—A second illustration, tracing from skiagram, showing fracture by compression violence resulting in a transverse separation of the bone. Note that exact transverse fracture must be rare and some obliquity is bound to be present in the plane of separation.

modern buildings, and we find that osseous structure tends to give way in the same manner. One of the transverse or oblique fissures that develops when the compressive and its accompanying tensile or pulling apart force are acting usually becomes the main plane of separation and we find, therefore, that following a compressive force there is usually a true oblique fracture. Should the force act quickly and with more than sufficient power to break the bone, we will find an almost transverse shearing off of the bone's continuity. Forces applied more slowly and with no great excess of power to break the bone will cause a more oblique fracture along one of the fissures which develops as the bone separates. These fractures are commonly termed flexion fractures in contradistinction to a second class known as torsion fractures. Buckling fractures, greenstick fractures, which are really rare, are subdivisions of flexion fractures and are a more or less transverse or oblique separation of the bone continuity (Fig. 357).

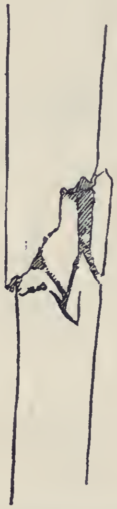

Fig. 356.—Another example of an oblique fracture from a slow moving force with the broken-out fragment on the side of the shaft exposed to the tensile force which tears apart the bone fragments.

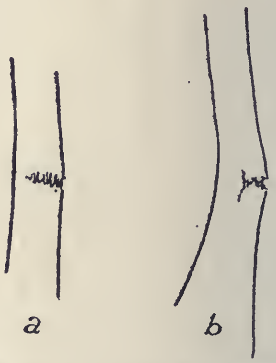

Fig. 357.—*a* and *b*, Greenstick fractures in children. Are tracings of skiagrams. Note the tendency to conform to the diagrammatic mechanism used for illustrating compression fracture. They are merely subdivisions.

In buckling fractures the compacta breaks at its thinnest point on the side of the shaft of the bone subjected to the greatest compression stress, usually becoming angulated or overlapped in the longitudinal axis. In greenstick fractures the compression force applied is usually not sufficient to cause a complete fracture, and it ceases when it has reached a point short of complete division of the osseous tissue. The fractured ends consequently are then interlocked with a slight angularity and very little lateral or rotatory displacement. These fractures are found in children's bones, which, as we have mentioned, contain a smaller proportion of calcium salts. They are more elastic and are tougher than the brittle bones of adults, and we expect to find these incomplete fractures in children on that account. The heavy vascular periosteum of children's

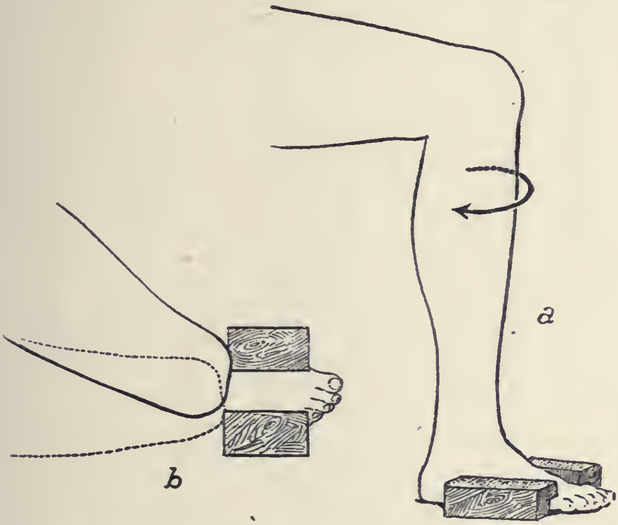

Fig. 358.—Diagram illustrating torsional violence applied to the leg. *a*, Imagine a thigh held rigid and the foot turned out in the direction of the arrow by pushing the block outward. This is the actual mechanism in leg fractures from torsional violence caused by slipping or twisting of the foot outward. *b*, Imagine the foot held securely by blocks and the thigh rotated outward to the position of the dotted lines. This gives the same mechanism, resulting in the same type of fracture as *a*. The reversal of this movement causes the rare spiral fracture, which proves the rule.

bone is also a factor in the production of greenstick type of fracture.

The application of torsional violence results in a spiral character of the resulting break in the bones (Fig. 358). Let us discuss the mechanism of ordinary spiral fracture of the leg. There are two mechanisms, that is, either the periphery or foot portion of the limb is fixed and the bone is subjected to a twisting violence from the trunk above, or, as is more commonly the case, the proximal portion of the limb is fixed and the distal portion or foot undergoes the twisting violence. This is the common mechanism induced whenever the foot slips outward in walking or stepping off a small elevation. A torsional fracture is not a

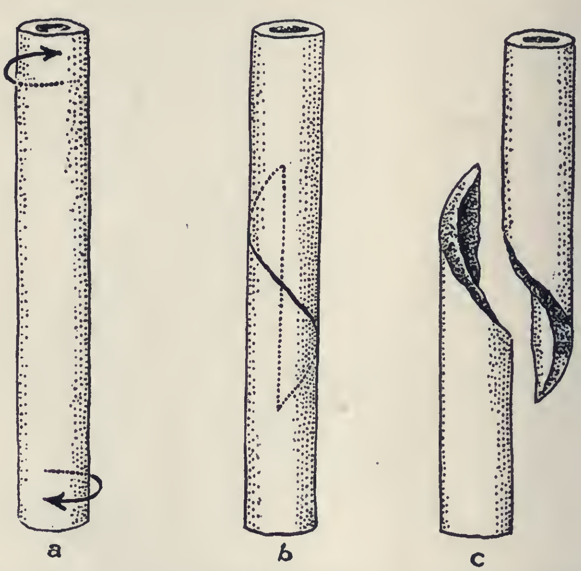

Fig. 359.—*a*, A bony cylinder subjected to torsional violence. The lower end represents the foot portion twisted outward in the direction of the arrow, as in an outward slipping of the foot. The upper arrow indicates the restraining force and fixed knee. *b*, The tendency for tubular bone to unroll in response to torsional violence. The two points of beginning separation usually lie on the same surface, one directly above the other and connected by a plane of spiral separation of varying angles. *c*, Complete separation of bone tubular shaft which occurs experimentally when torsional violence is applied illustrating this mechanism.

true oblique fracture. I have tried to explain that an oblique fracture is caused by compression violence applied against the shaft of a long bone. The angular points of the break are on opposite sides of the shaft. When we study spiral or torsional fractures we find the sharp points of the fragments are on the same surface of the bone, and usually on the posterior surface of a bone such as the tibia. To understand, we must compare a long bone to a cylinder of more or less uniform construction, which is subjected to axial torsion beyond the point of elastic limit. When a cylinder gives under this axial torsion, a loss of continuity follows and a spiral separation results (Fig. 359). This spiral separation takes the opposite direction to the torsional violence, that is to say, a spiral fracture runs down the shaft of a long bone in either the right-hand or left-hand direction, much as a corkscrew edge. Under torsional strain the bone starts to give at some weak point and tends to unroll in its longitudinal continuity, giving this spiral character (Fig. 360). However, we know that fractures are not easily or simply analyzed and we must not forget that as a spiral separation down the shaft of a long bone persists, there is going to be added some flexion stress from the change of weight bearing from falls or from muscular action. The whole effect then rarely becomes a true torsion unless the leg is supported and the foot or body twisted completely around when no weight bearing is in operation. If flexion is combined with torsion, as it is in the usual spiral fracture, we may expect that there is a longitudinal plane of separation connecting the initial points where the bone started to give under torsional stress. We find that each fragment contains a sharp or wedge-shaped point, one lying vertically above the other. Young bones, being more elastic, present a spiral which is steeper than that found in the bones of adults. It is also true that in the small long bones, even those of the hand, the spiral fractures have a steeper pitch than those involving the large bones.

In the application of these principles to fractures of the leg we find that the peripheral portion is the foot and the proximal portion is the leg and thigh. Usually fractures occur in the leg because the foot is violently and suddenly twisted outward. Remember, I am speaking of torsional fractures, not of fracture from direct compressive violence (Fig. 361). It is very rare that in walking we tend to twist our foot inward. The normal position of the foot is properly thrown slightly outward, especially when we are in the act of swinging it forward. If it strikes an object or is caught during its excursion we expect the torsional stress to be exerted in an outward direction, and an examination of the roentgenograms of these torsional fractures leads us to

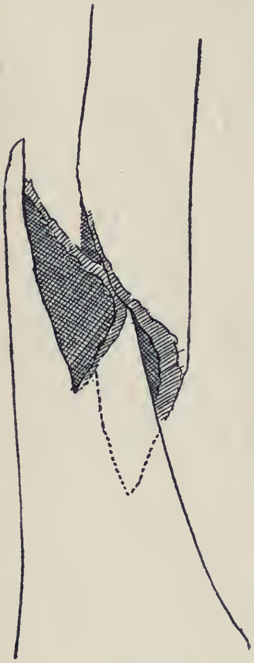

Fig. 360.—Tracing of a spiral fracture of the femur, illustrating the mechanism of spiral separation. Note how nearly it conforms to the diagrammatic figures.

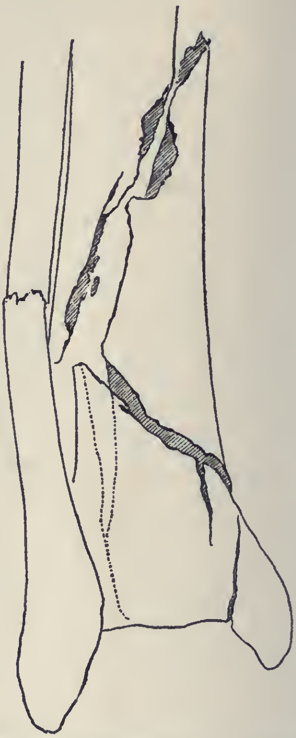

Fig. 361.—Compression fracture of lower third of leg. Boy riding a bicycle caught next to a fixed wall and leg subjected to lateral pressure. No torsion; no spiral fracture. Note the oblique plane of bone separation and the conformity to type of the direct violence fracture.

conclude that this is so. Why do we find that this is so? Because in practically all torsional fractures of the right leg the spiral separation of the bone is left-handed, that is to say, the spiral starts at the top and goes down in a left-hand direction, like a spiral staircase, opposite to the torsional violence which twisted the leg outward or to the right. In the left leg the opposite is true, and spiral fractures there are found to be almost universally right handed. The rare exceptions to this rule are caused by conditions I have mentioned when the periphery or foot portion of the leg is fixed when caught between two points, such as a railroad frog or blocks of some kind. Even with the peripheral portion fixed the body or proximal portion may be twisted in either direction. If it is twisted outward, we would find

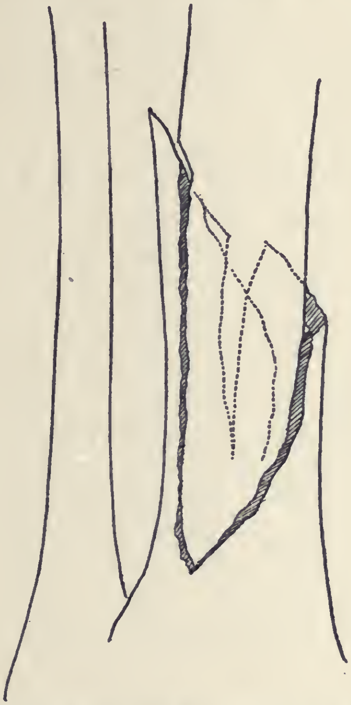

Fig. 362.—Torsional fracture of lower third of leg partly reduced. The spiral unrolling of the bone corresponds to the diagrammatic representation and the difference from compression fracture seen in Fig. 361 is evident.

a reverse of the rule given, and if inward, the usual type of spiral separation would ensue.

When we come to reduce fractures, to apply splints, and extensions we must bear some of these basic and elementary points in mind, and in dealing with any specific fracture an attempt must be made to reverse the action of causative force. All fractures are worthy of a physical analysis. That leads to better understanding of their pathology and, consequently, to better treatment.

CLINIC OF DR. GATEWOOD

Presbyterian Hospital

CARCINOMA OF THE RECTUM

Summary: Prolapse through sacral anus following resection of carcinoma by Kraske method one year previously. Utilization of prolapsed bowel in reconstruction of rectum.

The patient upon whom I am to operate this morning first came to me a little over a year ago. She is a single woman, seventy years of age. At that time she complained of weakness, loss of weight, hemorrhoids, and tarry stools. The history alone made me suspicious of a carcinoma of the rectum, as she stated that the hemorrhoids had been present for about four months and it is unusual to have hemorrhoids suddenly develop in people of that age. Close questioning failed to reveal a history of the passage of mucus or pus, but microscopic examination of the stool showed some pus. There was no history of constipation, but all of the stools had been mushy, so that obstruction would necessarily have had to be almost complete to give symptoms of ileus. She had complained of very little pain, although there was a history of some discomfort, particularly when sitting for a considerable time. She first noticed the loss of weight about four months before I saw her, and thought that altogether she had lost about 20 pounds.

Physical examination was practically negative except for the rectal findings and the evident loss of weight. A cauliflower-like mass about 3 cm. in diameter could be felt on the anterior surface of the rectum. It seemed to be somewhat movable and bled rather freely. Two small hemorrhoids were present, but were not tender and could not have been in any way responsible for her discomfort.

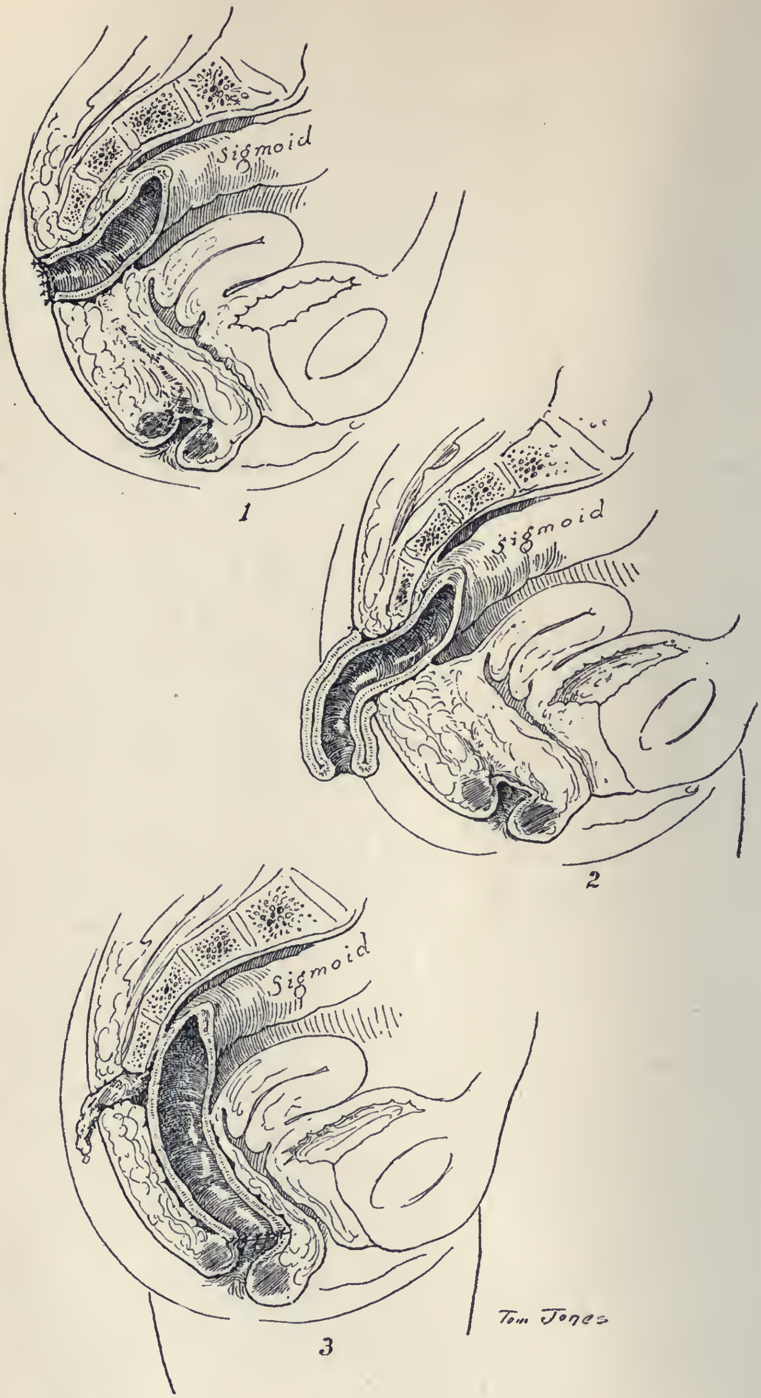

Fig. 363.

Under ether anesthesia I made a midline incision from the middle of the sacrum to the anus and removed the coccyx. This allowed me plenty of room to work. The rectum was entirely freed both in front and behind, care being taken not to enter the vagina. The bowel was then split longitudinally along the posterior wall, with the idea that it might be possible to do a local operation and remove the tumor with the cautery without destroying the continuity of the entire rectal wall. However, the tumor was so extensive that this was found to be impossible and a resection of the gut at the rectosigmoidal junction was deemed necessary. Considerable difficulty was encountered in bringing the bowel down sufficiently to make a sacral anus without tension, but this was finally accomplished by suturing the mucous membrane to the skin just below the sacrum with interrupted silk. The lower segment of the rectum was removed, leaving the anal sphincter and about 2 cm. of the mucosa. There were a few small glands in the fat which on section proved to be inflammatory.

The patient made an uneventful recovery and left the hospital in about four weeks. There has been no evidence of recurrence, but she complained from the start of a good deal of discomfort due to incontinence. She does housework and it has been imperative that she resume her duties in order to make a livelihood. About six months after her operation she came to me begging for some relief. At the time of her operation I had proposed an inguinal colostomy in the event that I could not preserve the normal canal, but she absolutely refused to consider it. I again suggested an abdominal anus, but it was refused.

The question of the type of operation to be done in carcinoma of the rectum is still open to considerable debate. Personally, I feel that no set rule should be given and that the operation should be planned in each instance depending upon the location, the type of tumor, and the condition of the individual patient. Here we have a woman past seventy who is only a fair risk. She had

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Fig. 363.—1, Diagram of condition at completion of original operation. 2, Condition at time of admission for second operation. Note prolapse of bowel through sacral anus. 3, Completion of second operation.

no evidence of metastasis and the growth did not seem to be very extensive. In such a case it seems to me much safer to do a one-stage operation from below. When seen early enough, local operation unquestionably gives excellent results, with a very low mortality and a good percentage of permanent cures. This is especially true of tumors occurring in the lower 3 cm. of the bowel, though unfortunately they comprise only about 6 per cent. of cancers of the rectum. Such an operation resembles the removal of a cancer of the lip or an epithelioma of the skin. It can be done best by means of the cautery knife, the raw surface being sutured over after removal of the tumor and the bowel closed. In the more advanced cases if the tumor is low down a radical removal of the entire section of the rectum with the neighboring glands and fat is the operation preferred by most surgeons, although a certain number insist that an abdominal exploratory should be made in every instance. The sacral type of operation was introduced by Kraske and has been variously modified by Qúenu, Bardenheuer, Harrison Cripps and others. It is limited to tumors in the lower 5 or, at most, 6 inches of the bowel. The greatest objection, aside from the examination of the abdomen for metastases, to this operation is the incontinence of which this patient complains. Some patients develop a forty-eight-hour habit and have very little difficulty. Where it is possible to retain a part of the anal sphincter, even though small, patients have a surprisingly good functional result. If I had to have an artificial anus I believe I should prefer the inguinal or abdominal type. Patients with a left inguinal colostomy not only have better control on account of the loop of bowel which forms a reservoir like a plumber's trap, but also because, on account of its greater accessibility, they can wear a better protective apparatus.

As this woman refused further operation, I advised her to follow a careful diet and to content herself with her lot.

She now returns with a somewhat different picture. During the past six months she has gradually developed a prolapse through the sacral anus. This has caused her a great deal of discomfort. It projects, as you can see, about 6 inches when

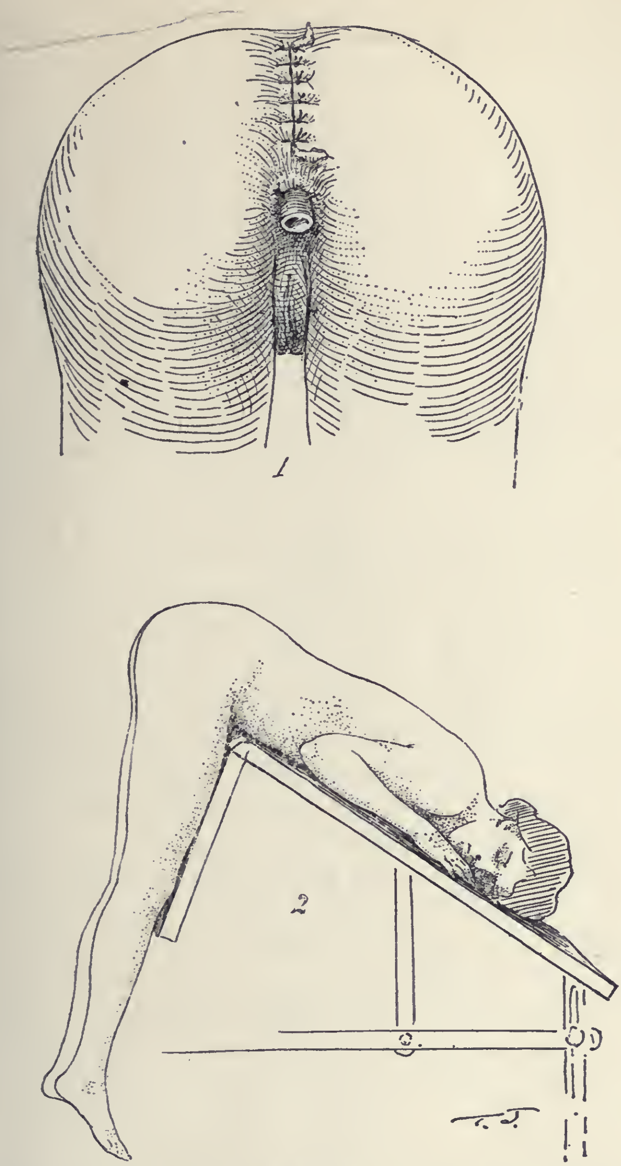

Fig. 364.—1, Conclusion of operation; note gauze drain in upper angle of incision and tube stitched into rectum. 2, Illustrating position of patient on the table during operation.

she coughs or strains, or after she is on her feet for a short time. It is very readily replaced when she lies down. The idea occurred to me that it might be possible to restore the fecal current to its original channel by making use of this prolapse, and that is what we shall attempt to do this morning.

I am making a curved incision around the artificial anus and I am also dissecting out the old scar, continuing my incision as far down as the original anal opening. I am dissecting the bowel loose from the sacrum for a distance of 2 or 3 inches. In doing this I have opened the peritoneal cavity in front. Into this opening I am packing a laparotomy pad. With the prolapse, I now have plenty of viable gut to bring down to the old anal opening. The freed bowel, as you can see, is about 8 inches in length. I will divide the anal sphincter at the site of my previous incision. I am now closing the peritoneal opening with catgut. Although this opening was made accidentally, it has been of considerable benefit, as it enables me to bring the prolapsed bowel down to better advantage. You will notice that there is no difficulty in suturing the rectum to the anal mucosa by means of interrupted silk sutures. I have been very careful to avoid any tension. It is still necessary to suture the subcutaneous tissues with a few catgut sutures, diminishing the dead space, and thereby lessening the likelihood of necrosis. I am now inserting a large rubber tube into the rectum, allowing it to extend well above the anastomosis. It will be held in place by a couple of silkworm-gut sutures. The retrorectal space is packed with iodoform gauze and a few interrupted sutures inserted in the line of the incision (Fig. 364).

Postscript.—Three months after operation the patient is entirely well and has resumed her usual work. She has no trouble with incontinence. There is no evidence of recurrence of the carcinoma, but there is some tendency to stricture formation at the site of the anastomosis, and dilatation with bougies may be necessary later.

CLINIC OF DR. G. L. McWHORTER

PRESBYTERIAN HOSPITAL

AN UNUSUALLY LARGE SARCOMA INVOLVING THE STOMACH

Summary: Salient points in the clinical record; results of exploratory operation; necropsy report; frequency of sarcoma of the stomach; varieties of growths and clinical behavior.

MR. J. D., aged forty-five, entered the hospital March 23, 1919, on the medical service of Dr. J. B. Herrick. The patient complained of a large swelling in his abdomen. He stated that he was kicked in the left side of his abdomen by a mule in August, 1918. He was stunned for half an hour and made quite sick at his stomach by this blow. Following this he felt perfectly well and did carpenter work until October. During October he developed an area of tenderness in the left side of his abdomen extending from the umbilicus to the ribs. This came on suddenly one day with a feeling of chilliness and aching in his back, arms, and legs. On the evening of this day he became nauseated about one-half hour after supper and vomited. Pain developed in the left upper quadrant and remained fairly constant. In November he passed loose bloody stools three to four times a day for a few days, and at that time noticed a hard lump beneath the margin of the ribs on the left side. This mass gradually increased in size, and about December 10th it softened in its upper part and increased in size downward very rapidly. Marked swelling of the abdomen began and has progressively continued since that time. He has had irregular periods of pain severe enough to keep him awake. These were sometimes relieved by lying on the left side or by having a bowel movement.

The patient has been constipated since Christmas and has had to take cathartics frequently, the stools sometimes becoming loose and bloody after their use. He has had dyspnea constantly since Christmas and has recently developed a cough. He has had nausea and vomiting associated with epigastric distress, which come on immediately after eating. For the past three months he has had a frequent desire to urinate, particularly when standing. He has lost 19 pounds (185 to 166) in the last six months.

His previous history is negative except for the kick from the mule in August.

On examination, the patient is found to be a well-nourished male; he walks slowly and has a prominent abdomen.

The examination of his head is negative. On examining the chest the breath tones are normal, but excursion is limited. The lungs and heart are pressed upward by the mass filling both sides of his abdomen. The abdomen is very prominent, the size of an eight months' pregnancy, due to a large mass fairly smooth anteriorly, but having an irregular outline. There is evidence of only a moderate amount of fluid in the abdomen. The extremities are negative. There is no edema.

Fluoroscopic examination by Dr. Herrick, March 27th, showed the heart pushed markedly upward. The barium meal was not well seen in the stomach on account of the large tumor.

The urine examination was negative except for a trace of albumin.

The secretory test-meal at the end of one hour, March 29th, gave 50 c.c. There was no free hydrochloric acid, but the total acidity was 45. The Weber test for blood was positive. On April 4th a secretory meal gave 125 c.c. of normal appearing contents. It titrated 18 free hydrochloric acid and 46 total acidity. The test for blood was positive.

Examination of the stools was negative except for a positive Weber blood test.

On March 26th there were 3,800,000 erythrocytes and 7000 leukocytes. The differential leukocyte count gave polymorphonuclear leukocytes 57 per cent.; large mononuclears 17 per cent.; large lymphocytes 6 per cent.; small lymphocytes 7 per cent.; eosinophils 1 per cent.; basophils 1 per cent. The hemoglobin was 56 per cent. The systolic blood-pressure was 186 and the diastolic 124.

The abdomen became very much more prominent during the two weeks following his admission to the hospital and dyspnea became very marked. The tumor itself increased in size very rapidly and the fluid increased in amount so that the abdomen became immense in size. His temperature, with two or three exceptions, did not go above 99° F.

Dr. Herrick transferred him to my service for a laparotomy to remove the fluid and relieve the pressure, and also to explore the abdomen, as the patient otherwise was in fairly good condition.

Operation (*April 14, 1919*).—Under local anesthesia I made a left rectus incision and removed about 2500 c.c. of clear straw-colored fluid. There was a huge tumor present. It was continuous with and passed over the stomach, fusing with the anterior edge of the liver.

In the left upper quadrant a thick leather-walled palpable mass containing fluid could be outlined. This was continuous with the tumor and in the position of the body of the stomach. It felt like a "leather bottle" stomach and extended high up under the diaphragm. The large tumor extended down completely over the intestines. The intestines as far as could be palpated were free and posterior to the tumor. The mass on gross examination was slightly lobulated, but was smooth and gray over the stomach, somewhat resembling a carcinoma. However, large dilated veins were present over the main mass lying below the stomach and extending to the pelvic inlet. Pieces of the tumor were removed for microscopic examination and the abdomen was closed with reinforced sutures.

The patient noted immediate relief following the removal of the fluid and subsequently complained less. About ten days after operation the patient became worse, his pulse poor, and he developed incontinence of urine and feces. The day before he died he became somewhat delirious. He was irrational at times and breathing was labored. This became progressively worse until his death, April 27, 1919.

On microscopic examination of the tissue removed we found typical sarcoma cells. Some of the cells were spindle shaped and some were mixed embryonic cells.

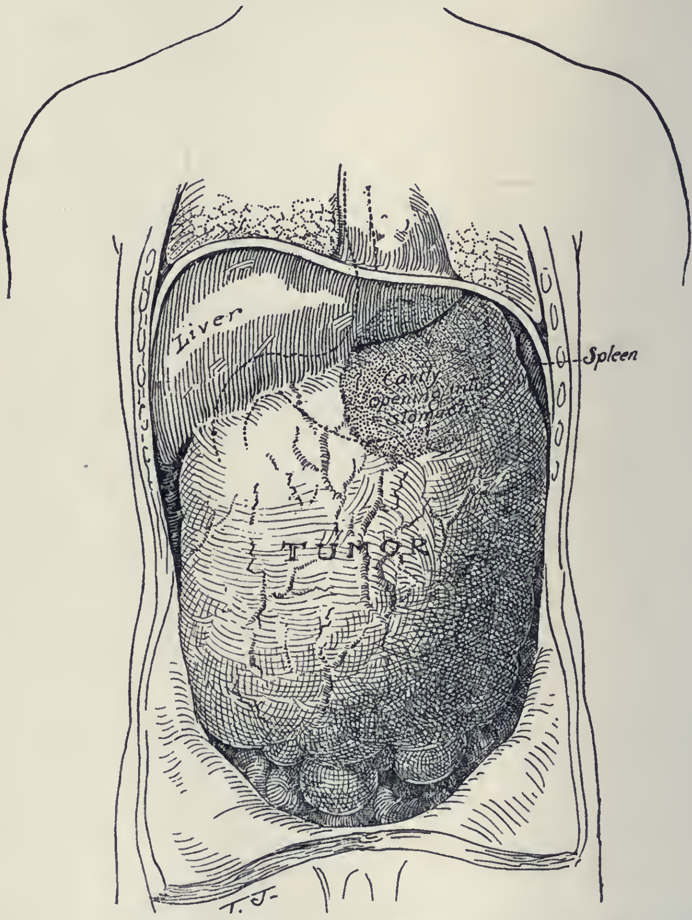

Fig. 365.—Sarcoma with large cavity opening into the stomach. Large veins present over the surface and an irregular lobulated lower portion.

Before continuing the discussion I will give Dr. B. O. Raulston's findings at the necropsy.

When the abdominal cavity is opened in the usual manner a grayish, irregular, nodular tumor is found occupying most of the cavity from the pelvis to the diaphragm (Fig. 365). The

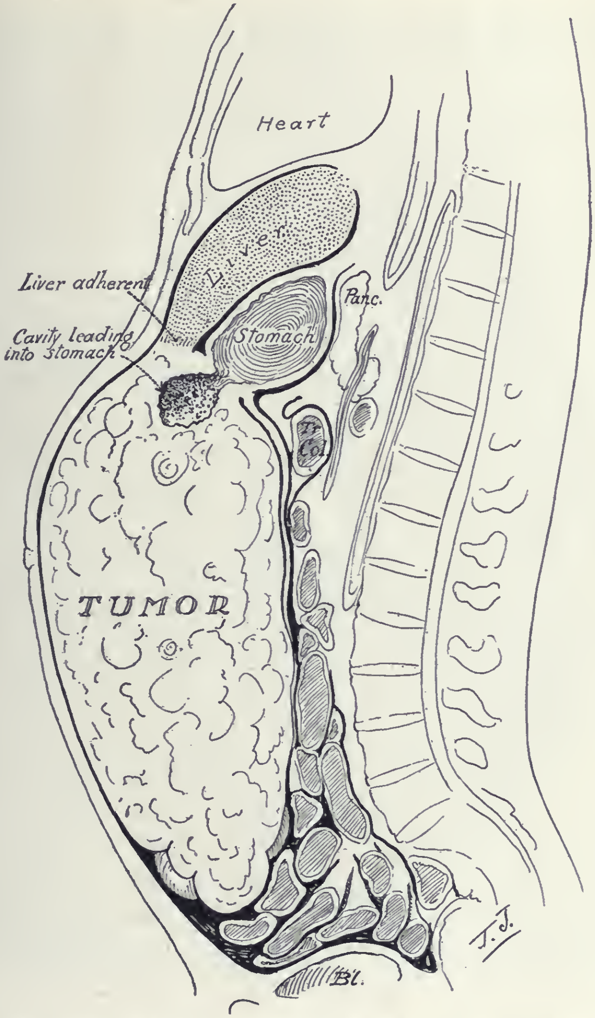

Fig. 366.—Sketch showing the relation of the tumor to the stomach, fusion with liver, and freedom from the intestines. Drawing somewhat schematic.

stomach is not seen, the lower margin of the left lobe of the liver is barely seen and is firmly adherent to the mass, the small bowel is for the most part crowded into the pelvis and space back of the lower end of the tumor. The omentum is represented by a narrow fringe of yellowish tissue across the lower and posterior portion of the tumor, and in it there is a mass of veins so dilated that they measure from 0.25 to 0.75 cm. in diameter.

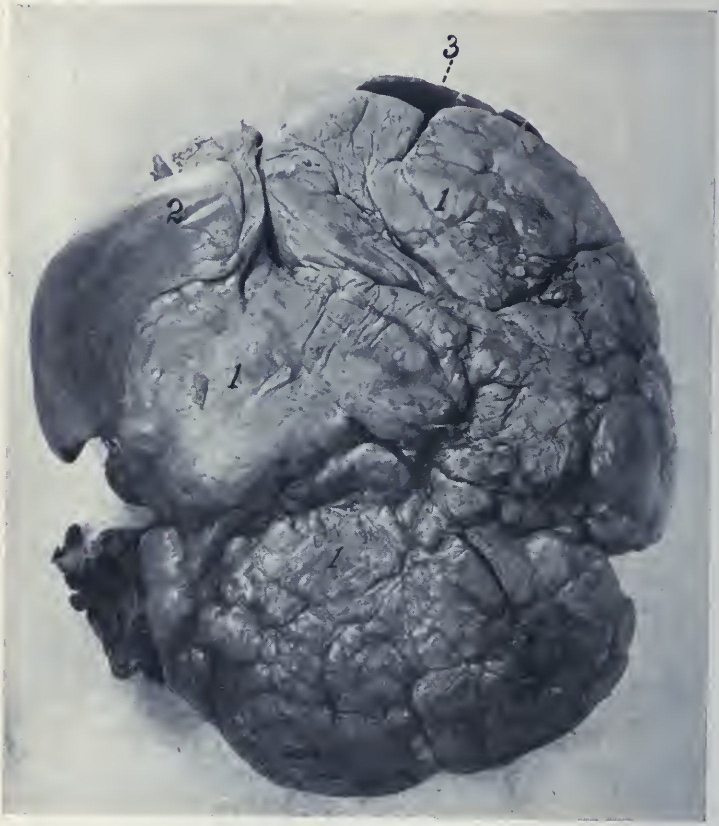

Fig. 367.—Photograph taken at necropsy showing the tumor (1, 1, 1), liver (2), and spleen (3).

In the peritoneal cavity there are about 1500 to 2000 c.c. of clear straw-colored fluid. When the lower portion of the tumor is lifted forward the transverse colon is seen passing across and loosely adherent to its middle posterior portion. The maximum dimensions of the mass are transverse, 37 cm.; vertical, 28 cm.;

anteroposterior, 16 cm. With the left lobe of the liver, the spleen, pancreas, stomach, and duodenum, all of which are apparently

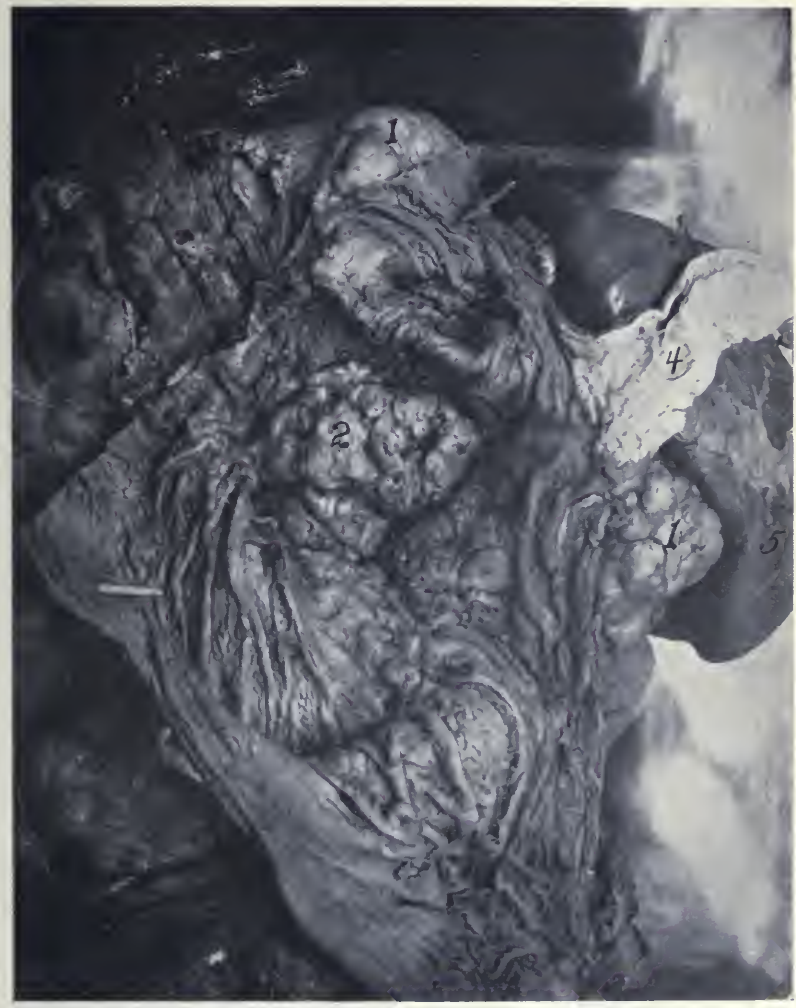

Fig. 368.—Photograph showing tumor (1), mucosa over tumor of the stomach wall (2), sinus through the stomach wall into the tumor mass (3), esophagus (4), liver (5).

of normal size, the tumor weighs 18¾ pounds (8.53 kilograms). It is continuous with the wall of the greater curvature of the stomach and its invasion of this wall is shown in Figs. 366 and 367. These figures also show the relation of the tumor to the spleen, liver, and stomach.

In the body of the stomach there is an irregularly round, rough, cauliflower-like mass with an average diameter of 7.5 cm. In the central portion of this mass there is an irregularly shaped necrotic region through which a sinus opens into the upper and left portion of the tumor, indicated in Fig. 368. It is evident that the tumor is divided roughly into three portions topographically, a single lower and two upper portions (Fig. 367). The left one of the upper portions fluctuates over its anterior surface, and when pressure is made upon it thick brownish fluid is forced through the opening into the stomach.

By microscopic examination of pieces of tissue removed from various parts of the tumor a diagnosis of sarcoma, mixed, round, and spindle cell, is made. The main points in the anatomic diagnosis are as follows: Bilateral pulmonary embolism; thrombosis of the left iliac vein, large sarcoma of the stomach, with adhesions to the liver, spleen, pancreas, and transverse colon; ascites; marked dilatation of the veins in the omentum; displacement upward of the diaphragm; recent healing surgical incision of the anterior abdominal wall; emaciation and anemia; fatty changes in the liver, kidneys, and heart muscle; moderate atheromatous changes in the lining of the aorta and coronary arteries.

The report by Dr. Raulston is of value because non-carcinomatous neoplasms of the stomach are rare. Lipoma, fibroma, adenoma, and myoma have been found, but sarcoma is the most frequent. Fenwick found sarcoma occurring in 5 to 8 per cent. of all primary growths; however, most sarcomas are diagnosed clinically as carcinoma. Fewer of these are operated, since obstruction is less common than in carcinoma, and it occurs late as a rule when present. Since their growth and metastases are very rapid, they are usually inoperable when first seen, and necropsies are not always obtained.

Corner and Fairbanks collected 175 cases of primary sarcoma of the gastro-intestinal tract—58 of these were sarcomas of the stomach and 64 sarcomas of the small intestine. The location differs from carcinoma in that sarcoma occurs more frequently in the small, while carcinoma occurs much more frequently in the large, intestine. Sarcoma occurs usually in the body of the stomach and in the esophagus, about an inch above the cardia, while carcinoma occurs chiefly at the pylorus and the cardia. Schlesinger states that sarcoma develops chiefly from the greater curvature.

Sarcoma may be primary or secondary in the stomach. Any type of sarcoma may be present, but with the exception of lymphosarcoma primary sarcoma usually arises from the muscularis or submucosa. With the exception of lymphosarcoma, secondary sarcoma is rare, but the lymphosarcoma is more frequent as a secondary than a primary growth.

Primary lymphosarcoma may occur at any age, but it is most frequent between twenty and thirty-five years, while other types of sarcoma appear more frequently between forty and fifty.

Practically all types of sarcoma have been found—myo-, fibro-, angio-, lympho-, myxo-, alveolar, round-cell, mixed-cell, and spindle-cell sarcoma. Over one-half of these have been found to be of the round-cell variety (Fenwick). These growths may be annular, polypoid, or may be circumscribed nodules and may grow into the lumen or extrinsically. Lymphosarcoma usually and other types of sarcoma sometimes form extensive infiltrations in the wall. The former metastasizes chiefly along the lymphatics.

In nearly all sarcomas the mucosa is intact early, but later it may ulcerate. A sarcoma may form a diffuse tumor involving the entire stomach, spreading, unlike carcinoma, into both the duodenum and esophagus.

The large subserous tumors are liable to undergo cystic degeneration. In one case reported the cavity was opened at operation. Many of these large tumors are of the spindle-cell type. Lymphosarcoma especially may tend to dilate the wall, but it may also obstruct the lumen due to its size or due to interference with peristalsis by infiltration of the wall, even though the lumen may be dilated. Kundrot states that metastatic growths in the intestine from lymphosarcoma never produce stricture, but lead to dilatation.

Metastases from primary sarcoma of the stomach are common. Corner and Fairbanks found secondary growths were present in 40 per cent. of the reviewed cases. They found that there was glandular involvement in one-third of the cases. This is especially frequent in lymphosarcoma. Sarcomas of the stomach metastasize frequently in the intestine and form nodules in the skin.

In sarcoma of the stomach no definite clinical diagnosis can be made as a rule, especially to distinguish it from other malignant growths. The difficulty becomes more evident when we know that in less than one-half of the cases reviewed by Corner and Fairbanks a palpable tumor was noted.

There are a number of symptoms which are an aid in the diagnosis, and when sections can be taken the diagnosis becomes certain. There are usually early wasting and anemia, vomiting is frequent, pain is often fairly constant, jaundice may be present. Irregular fever is common and there may be a persistent leukocytosis with an increase of lymphocytes. A tumor may be palpable, and this may be very large without symptoms of obstruction, or if obstructive symptoms are present, they appear relatively later than in carcinoma. This is partly due to the location of the sarcoma, which is usually in the body of the stomach. Hemorrhage is usually absent or is a late complication, although occult blood is found after the mucosa is ulcerated. The average course of the growth from the onset of symptoms is, on an average, six months.

Sarcoma forms metastases frequently in the skin and intestine. If nodules are present in the skin microscopic examination will usually determine the diagnosis, but even here we may have an associated carcinoma of the stomach. Kundrat states that metastatic lymphosarcoma never produces stricture of the intestine, but dilatation, while carcinoma forms a stenosis. In diffuse lymphosarcoma of the stomach dilatation may occur without stenosis of the pylorus. This should be differentiated from diffuse carcinomatous infiltration of the stomach, which thickens and contracts the stomach, giving rise to the malignant variety of "leather bottle" stomach. There is a similar condition which may be benign due to diffuse fibrosis of the stomach, sometimes called linitis plastica.

Swelling of the spleen due to congestion and hyperplasia is a frequent finding in both primary and secondary sarcomas of the stomach. Schlesinger found it present in all of his cases.

According to many authors no constant differences occur in the chemism of the stomach in carcinoma and sarcoma.

It is interesting to note that after one test-meal in the case reported normal free hydrochloric acid was found.

Particles of the tumor may be found in the vomitus or may be obtained by a stomach-tube.

The prognosis in sarcoma of the stomach even if operated early is poorer than in carcinoma. It is especially bad in lymphosarcoma. Death is more frequent in sarcoma through a perforative peritonitis than in carcinoma.

Brodowski reported a very large myosarcoma connected with the greater curvature of the stomach, weighing 12 pounds. It was 30 to 40 cm. long, 12 cm. thick, and 16 cm. broad. There was cystic degeneration with a cavity containing a purulent fluid in his case.

In the differential diagnosis there are some extrinsic conditions which should be considered and remembered. Tuberculous lymphadenoma is perhaps one of the most frequent conditions found. Lymphosarcoma is the most frequent primary retroperitoneal neoplasm. There may be an abscess of the retroperitoneal glands. Lipoma is found most frequently under the mesentery of the large or small intestine. Carcinoma of the testicle may involve the ileolumbar glands during the early stages.

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INCISED WOUND OF HAND

Summary: Compound fracture of metacarpophalangeal joint with complete severing of dorsal tendons; tendoplasty; postoperative treatment by massage and active motion.

THIS patient comes in with a bleeding wound on the back of the left hand. He states that while operating a band saw his hand slipped and the saw cut a glancing blow across the joint at the base of the fourth finger and the fifth finger at a point just distal to the base.

On examination I find a bleeding wound laying the fourth metacarpophangeal joint wide open. The dorsolateral third of the head of the metacarpal, or knuckle, is entirely cut through and held only by a strip of periosteum at its upper end.

There is a thin piece cut from the first phalanx which is attached to the capsule of the joint. The extensor tendon to this finger is entirely cut through.

On testing out the function of the finger I observe that, even though the extensor tendon is entirely cut, there is an appearance of some extension through traction on the web by the third and fifth fingers. There is extension of the fifth finger, but on examination of the wound the tendon from the extensor digitorum communis is found to be cut and the other extensor tendon to the little finger, the extensor digiti quinti proprius, is partially cut. The wound extends distally without involving the joint of this finger. The fourth interosseous muscle is cut at the level of the joint. It inserts on the ulnar side of the base of the fourth finger.

There are a few important anatomic facts which it is important to remember in injuries of this region. The synovial sheaths of the extensor tendons are not present over the knuckles, but begin about the middle of the metacarpal bones and extend an inch above the wrist. These sheaths do not intercommunicate as do those of the flexor tendons, and consequently the results of infection are not so severe. The tendons may retract an inch or more if cut in these sheaths, but if cut in other parts of their course they rarely retract more than half an inch. At the metacarpophalangeal joint the tendon aids in forming the dorsal ligament of the joint capsule, its border being indefinite. On the back of the first phalanx the tendon receives at its sides the partial insertions of the interossei and lumbricale muscles which send fibers into the capsule of the joint. These fibers form an aponeurosis which passes over the tendon like a sheath. The ligamentum capitulorum transversum separates the distal portions of the interossei muscles from those of the lumbricales. The former run dorsal to this ligament and the latter volarward. On account of the close relationship of the extensor tendon to the capsule the majority of tendon injuries at this point extend into the joint. When these joints become infected, as frequently happens, drainage should be established, preferably through bilateral openings.

The tendons forming the extensor digitorum communis are attached to each other just above the metacarpophalangeal joints by strong bands called juncturæ tendinum. This is the reason that it is difficult to extend any but the first finger alone.

There are no motor nerves in the region of this injury, and consequently the repair of the tendons and the head of the metacarpal, re-forming the joint, are the only problems. If we can maintain this piece from the head of the metacarpal in position with the capsule and tendon sutured, and provided we can avoid subsequent infection, we should get a return of normal function.

Operation.—The fragment from the head of the metacarpal is first placed in position and held there by a suture through the capsule at its insertion in the neck. The large flap of capsule is now turned back in normal position and sutured to its cut edge, also aiding in keeping the bone fragment in position. The thin piece of bone from the base of the first phalanx is cut away and a part of the capsule sutured to cover the cut surface of the bone. The aponeurosis over the distal fragment of the cut tendon is now split down a short distance so that by extending the finger a good end for suturing is obtained.

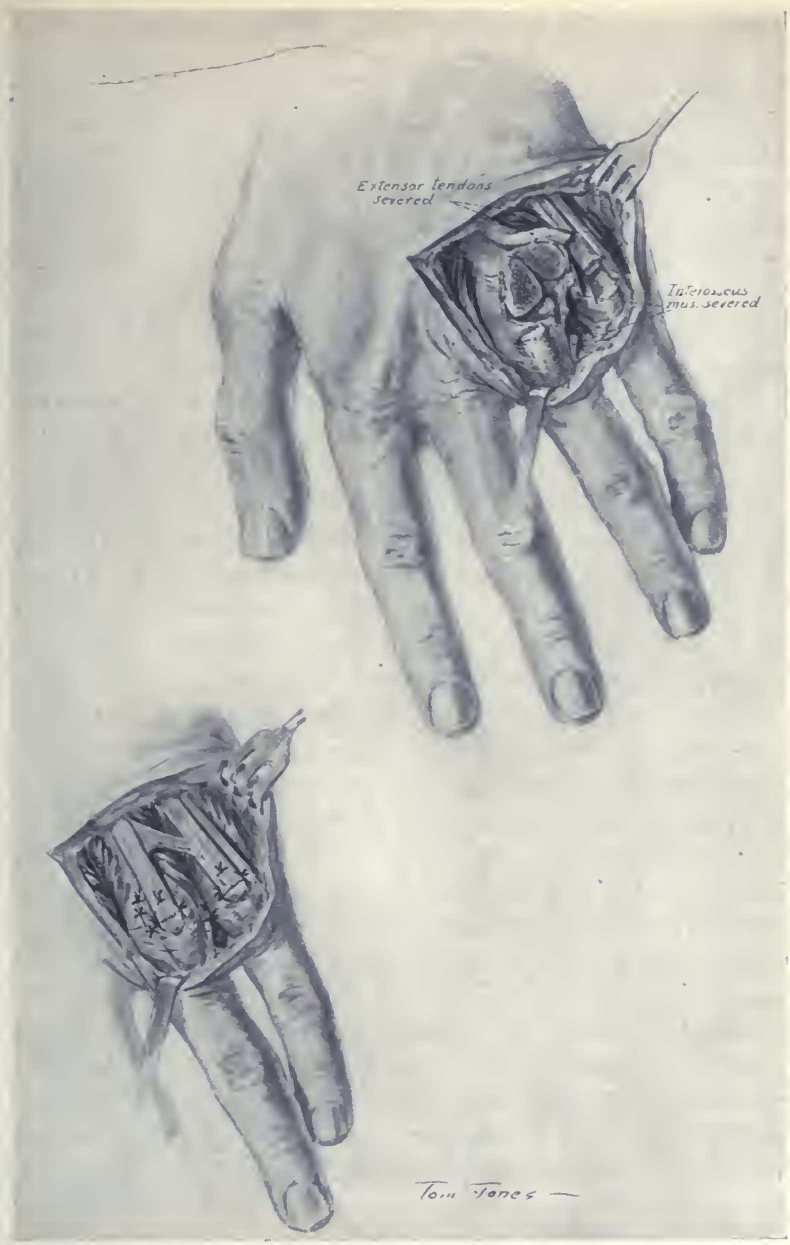

Fig. 369.—Incised wound of hand. Saw cut through the bone and joint with involvement of the extensor tendons of the fourth and fifth fingers. Reconstruction of joint and tendons.

I am suturing the ends accurately together by using two simple through-and-through sutures and one long mattress suture of catgut. A medium size chromic catgut is probably the best suture. The cut tendons to the little finger and the interosseous muscle are sutured in a similar manner.

All hemorrhage has now entirely stopped through ligation of several vessels. The subcutaneous tissues are drawn together over the tendons with fine catgut and the skin is sutured with waxed linen without drainage. In cases where there may still be a slight oozing of blood a few strands of silkworm-gut may be left in the lower angle of the wound as a drain for twenty-four hours.

The hand is put on an anterior padded splint, with the fingers in extension, and carried in a sling. Daily dressings are necessary for a few days until all danger of infection is over.

Passive motion, especially lateral motion and massage, will be started at the end of a week. Active motion will be started at the end of two weeks with very limited movements, increasing to full excursion only by the fourth week. The danger of too early use is that the ends of the tendon may separate, yet if the fingers be too long immobilized adhesions may form. There is danger of loss of function in the metacarpophalangeal joints due to vasomotor and trophic changes with edema from long immobilization in extension. We therefore permit the use of these joints as much as possible from the beginning of treatment, and encourage active motion and massage by daily removal of the splint.

After-history.—The wound healed by primary intention and the stitches were removed at the end of a week. The splint was removed for daily massage and left off at the end of two weeks. There was no evidence of ankylosis in the joint. Active motion is to be gradually increased.

CLINIC OF DR. CHARLES B. REED

Wesley Memorial Hospital

BREECH PRESENTATION—MANAGEMENT

Summary: Nephritis in pregnancy as an indication for emptying the uterus; technic of extraction; importance of maintaining correct position of operator's hands while delivering the baby's arms; technic of pubiotomy; its advantages; conditions under which it becomes the operation of choice.

Gentlemen: I have the pleasure today of showing you two cases of breech presentation, with their management.

The first case is Mrs. G., of Indiana, III para, age thirty-two, married eight years, one child living, no miscarriages. She came to our service March 3, 1919. She had her last period in July, the date being uncertain. About two weeks before she entered the hospital she noticed a puffiness all over the body, especially of the lower extremities. She says that three weeks previous a urinalysis had been made and the urine pronounced normal, but ten days later an examination revealed albumin. Her father and mother both died of nephritis. She has been getting worse gradually.

In the hospital urinalysis showed normal acidity; albumin 4 plus; many casts, both hyaline and granular; white blood cells numerous; specific gravity 1015 to 1018.

The blood showed a hemoglobin of 70 per cent.; white blood count, 10,000; Wassermann negative; blood-pressure, 180 and 98.

There was no cyanosis and no jaundice; but the face showed pallor and the body some weakness. Thyroid small; eye-grounds normal. Teeth have some pyorrhea pockets at the gum margins, but no abscesses.

Examination of the uterus revealed distinct heart tones, and by measurements a pregnancy of approximately seven months.

The diagnosis was acute nephritis.

The woman was placed on a strict milk diet with the intention of carrying her along from day to day and resorting to interference only if danger to her should demand it. Our hope was that she would go to the eighth month, since at that time the child would have a better chance of survival.

The blood-pressure did not improve. Analysis of the urine today shows about the same condition as when she entered. The patient has felt fairly well until yesterday, when she began to complain of weakness and cloudy vision. Feeling somewhat nervous about the possible onset of eclampsia, another examination was made of the abdomen, which showed the child in the sacro-right-anterior position, with measurements indicating a length of 48 cm. and heart tones of 135. It was decided to induce labor.

This morning, therefore, at 9 o'clock a Voorhees' bag No. 4, which is used frequently in this clinic, was introduced without anesthesia. Pains began at once and have continued regularly. The bag was expelled at 1.13 P. M., while the pains are continuing regularly up to the present time. Examination shows complete effacement of the cervix and complete dilatation of the os. Under ether anesthesia, therefore, we shall now proceed with the extraction in order to avoid the exhaustion of a long labor.

The hand enters the multiparous vagina rather readily. We rupture the membranes in passing through them. We seize the anterior foot of the child and deliver slowly to avoid trauma to the mother and child. The foot now appears followed by the knee. You will observe that the foot seems unusually swollen. As the breech appears, meconium is discharged, which is of no significance in breech labors. The second foot comes down and the breech appears in the vulva. We now place the thumbs of both hands on the sacrum, which is wrapped in a sterile towel, with the fingers underneath, and make traction slowly downward and outward until the cord appears at the vulva. Ordinarily we do not have much difficulty in the extraction and rarely any delay during this stage. The arms, as a rule, furnish the first and one of the most important complications. This child is rather small and we swing it through a long arc toward the side to which the belly points—in this case to the woman's left side. This throws the posterior arm deep into the hollow of the sacrum and makes it far more accessible and easy to deliver. Again, while keeping the left thumb on the vertebræ of the child, the fingers of my left hand seize the child's left elbow and sweep the hand down over the face and chest to delivery. This is an important maneuver, for if the elbow or arm is grasped by the thumb and fingers together extraction may proceed in the wrong direction and result in a possible dislocation of the shoulder or fracture of the arm (Fig. 370). The body of the babe is now carried through a long arc to the opposite side. The right arm delivers almost spontaneously and the head comes down. There is no obstruction as the head delivers and no tear. The cord is not pulsating and a Pettit Clamp is therefore applied and the cord is severed at once. The child seems to be in shock in spite of the

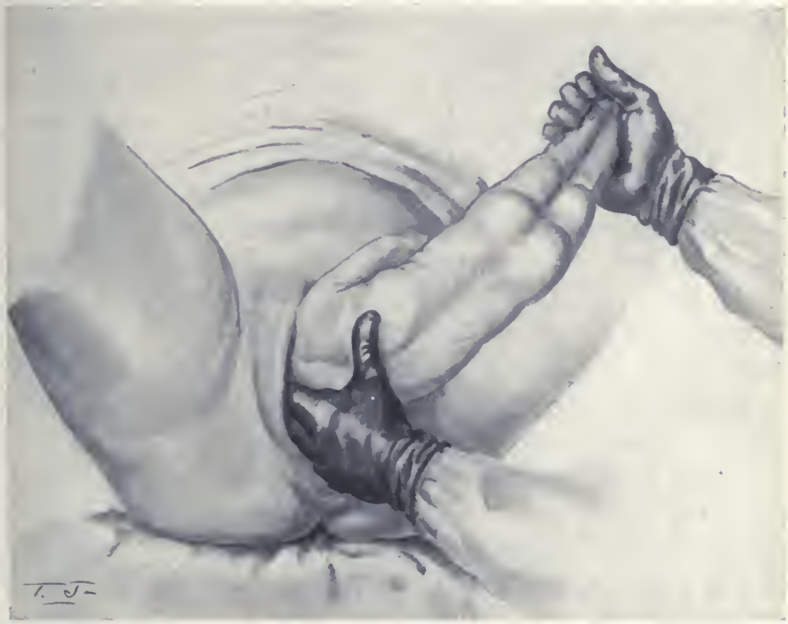

Fig. 370.—Breech presentation and extraction. Delivery of the posterior shoulder and arm. Note position of thumb of left hand.

easy delivery. As we make efforts at artificial respiration and stimulate the skin reflexes we note that the liver of the child is enormously enlarged. It seems to fill the entire abdomen. It is larger than a mere embryonal liver, which we expect to find large. Further, the ankle- and wrist-joints are extremely mobile, so much so that there seems to be no connection between the feet and legs or between the wrists and arms. The child is blue and gasps occasionally. It is not a healthy looking child, and one is in doubt as to the propriety of saving it. However, that is not our prerogative, and we shall do our best. The child breathes better under stimulation by hot water, in which it is now immersed, and seems to be breathing a little more rapidly. As the cry becomes lusty and the respiration fairly regular, we take it from the water and drop it in the blanket. We now drop silver nitrate, 1 per cent., into the eyes, and turn the baby over to the nurse.

The assistant now measures the child and finds it to be exactly 48 cm., which is well within the normal limit, and very gratifying as a confirmation of our antepartum measurements. The delivery of the placenta seems to promise no unusual features, so we may roll the patient into the next room and prepare for the following case.

Note.—The baby weighed 5 pounds and 8 ounces. Upon more careful examination it was found that a congenital heart lesion existed. The swelling in the arms, in the feet, and about the neck slowly disappeared during the next two days. The joints tightened up at the wrists and ankles, but the baby died on the third day. We were unable to trace any relationship between the nephritic affection of the mother and the condition of the child. The mother left the hospital in three weeks. There had been no rise of temperature and during the involution all edema had disappeared. The albumin had greatly diminished. The blood-pressure dropped at once after delivery, and averaged 130 and 96.

Case II.—The second case is also a breech, but the position is sacro-right-posterior. The patient is a primipara, twenty-three years old, at term. The patient has been in labor fourteen hours. The pelvis is flat and measures between the spines 23 cm., and crests 27 cm.; external conjugate, 19½ cm., which is 1 cm. lower than the average Baudelocque diameter. We have, therefore, a flat pelvis.

Examination three days ago gave a McDonald measurement of the uterus of 37 cm., and the Ahlfeld measurement of the child was 28 cm. From Ahlfeld's measurement by the usual method of subtracting 2 cm. to allow for the thickness of the abdominal wall, and multiplying the result by 2, we get a length of 52 cm. and a probable estimated weight for the child of 8 pounds plus. McDonald's measurement is 2 cm. above the average and would indicate that the pregnancy is a little over term. The size of the child also is well above the normal safe average of 7¼ pounds. Hence, owing to the high fetal mortality in these cases, especially in a primapara, and especially on account of the spatial disproportion between the head and the pelvis, which will be markedly increased when the child is above the average size, we will insert a Gigli saw before we begin to extract simply as a routine prophylactic measure. The insertion of the saw is an insignificant procedure and the instrument is easy to remove if not required, but in case the head is delayed at the brim and the child endangered by the slow extraction, the possibility of an immediate use of the saw may save the life of the child.

The patient's bladder is emptied and then by the technic of Döderlein, the so-called subcutaneous method, the saw is introduced. An incision about 2 cm. long is made directly over the pubic bone and about 2 cm. to the left of the median line. This incision extends through the subcutaneous fascia down to the pubic bone. Through this incision the saw carrier is passed from above downward and with the finger in the vagina it is guided close behind the pubic bone until it comes to the surface just outside of the left labium (Figs. 371 and 372). A nick with the knife lets it through. The Gigli saw is now attached and the needle carrier withdrawn. The saw is now in place and we can safely proceed with the extraction, knowing that delivery cannot be delayed beyond the eight-minute limit. First, however, to provide ample room for manipulation, we will do an episiotomy on the side opposite to the saw. This will prevent delay in extraction and an unnecessarily large tear, if tear there should be. By putting it on the opposite side we reduce the danger of a laceration extending up to or into the pubiotomy wound in case this operation should be required.

The membranes have ruptured and the breech has entered the pelvis. The hand now enters easily the artificially enlarged vagina and finds the foot beside the breech. The foot is pulled down. I call attention especially to the bulk of this foot and leg. This is manifestly a large child, and hence, before we proceed with the extraction we shall do a preliminary pubiotomy. It is far better to do this now than to wait for the necessity. It is better both for the mother and for the baby. Applying the

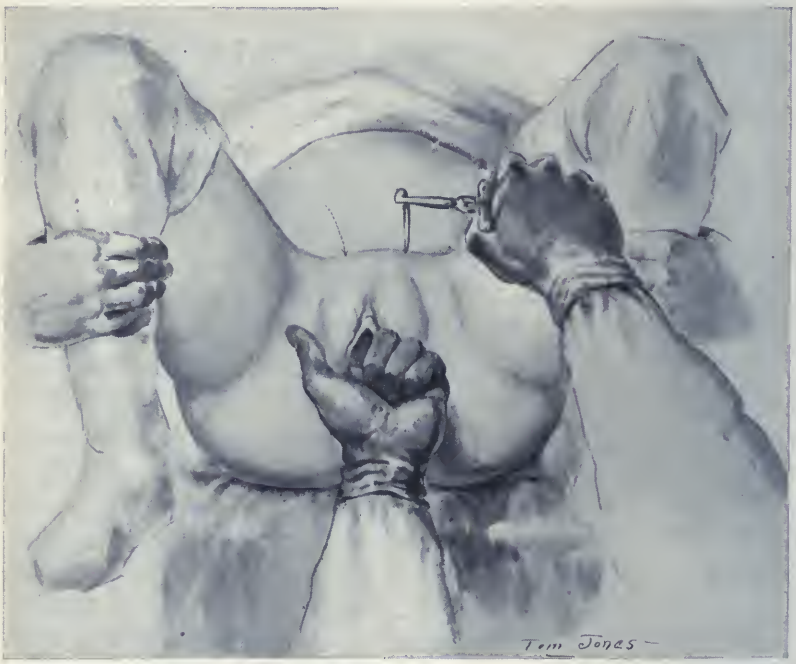

Fig. 371.—Introduction of the Döderlein needle 2 cm. to the left of the median line. The needle would usually enter on the opposite side (at point indicated by arrow) when used by the right hand.

handles we use an up-and-down movement of the blade, avoiding as much as possible any laceration of the soft tissues. The saw goes quickly through the bone and an assistant on each side steadies the leg so as to prevent undue separation of the bones (Fig. 373). There is some hemorrhage, as you note, but it is not serious. The assistant applies a sponge firmly to the site of the hemorrhage while we begin traction on the foot. The breech comes down easily and the body follows. Next we deliver the arms by the method you saw in the previous case. Note the position of the thumb (Fig. 370). However, the posterior arm in this instance is locked back of the neck and we are grateful for the additional room which the episiotomy and

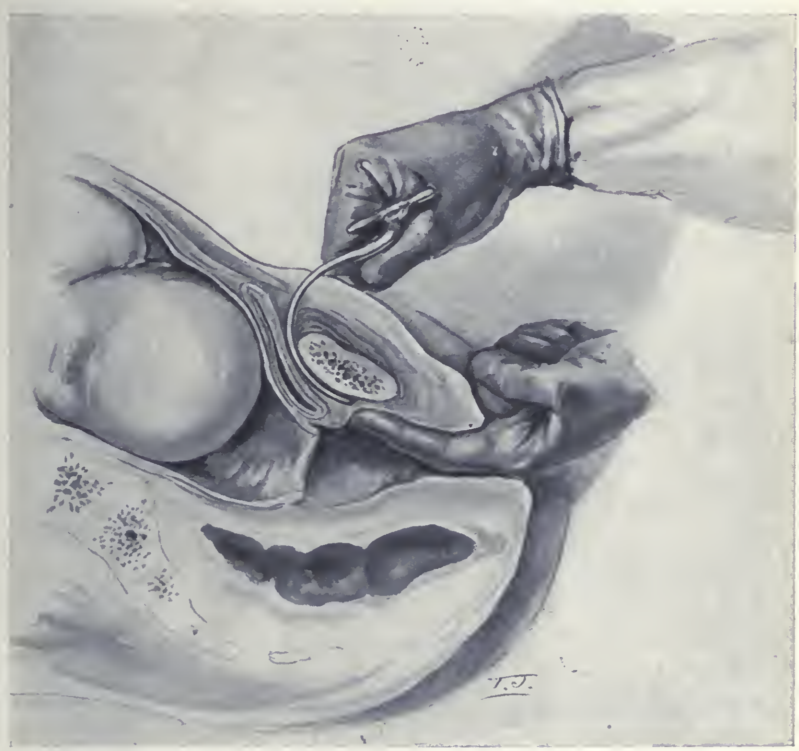

Fig. 372.—The needle passes behind the bone under the control of the index-finger.

pubiotomy provide. With considerable difficulty the arm is dislodged and swung forward. We are careful again, as you see, to keep the thumb on the child's back, so it is practically impossible to give a false direction to the arms as they are brought down. They are not pulled down, but wiped over the face and chest of the child. Now with the assistant making compression on the head from above, I extract. The child is placed astride the left arm and two fingers of the left hand are inserted in the mouth to maintain flexion, and with the first and second fingers of the right hand over the child's neck from behind and across the shoulders I make traction in the so-called Smellie-Veit maneuver. The head delivers. The child, as you see, is a female, large and strong. She has met no serious trauma in delivery and, therefore, cries at once and lustily. As soon as the child has cried, the lungs have obtained all possible blood and the cord can be cut. The Pettit clamp, which we use in these cases, has been used for the last five years in this clinic with great satisfaction. We find it clean and easy to sterilize. It is easy to remove, and devoid of danger. A 1 per cent. solution of silver nitrate is now dropped into each eye. A tape with a number corresponding to the one placed on the mother's arm is now put on the child's wrist for the purpose of identification. The child is measured and confirms the antepartum estimate of

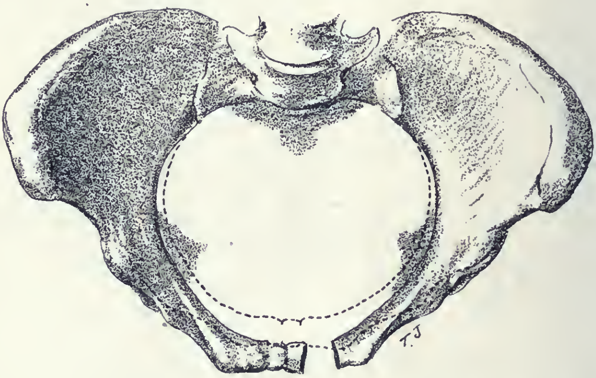

Fig. 373.—The effect of pubiotomy. The dotted line represents the iliopectineal line of the pelvis before division of the bone.

the length. The tape shows 52.25 cm., while the estimate, as you remember, was 52. Head diameters: biparietal, 10½ cm.; suboccipitobregmatic, 10½ cm.; bitemporal, 9½ cm. The babe now goes to the nursery.

Note.—The babe weighed 8½ pounds.

In this case I am confident we would have lost the child if delivery had been attempted before the pubiotomy was performed.

The mother: While waiting for the placenta we inspect the result of the delivery. There is no tear vaginally. The ends of the pubic bones are separated to the width of 2 fingers, but the chasm is still covered with mucous membrane and submucous tissue. We now repair our episiotomy wound, bringing skin to skin, muscle to muscle, and mucous membrane to mucous membrane. The placenta appears in the midst of our work and is properly received in a sterile basin. The membranes follow. We now finish the repair. We place a couple of small sutures in the skin opening where the saw carrier went through and clean up the patient. With a pad in the vulva the back is carefully dried. She is placed on clean linen and a broad adhesive strip, at least 3 inches wide, is carried entirely around the pelvis between the trochanters and the crests of the ilia. The woman is now taken to her room and put upon a fracture bed. The after-treatment presents no particular complications as a rule. In twelve hours the patient may be turned on her side and on the third day she may move herself.

This operation has many advantages over the more serious operation of cesarean section. The mortality for mother and babe is less. The prostration afterward is not so severe. It can be done or not done as may be decided after the first stage of labor. The mortality in the case of the mother is about 2 per cent., or very nearly that of a normal labor, while that of the babe is 4 per cent. in selected cases with favorable conditions. It is to be noted that the puerperium is usually pyrexial, but rarely high. This is probably due to the absorption from the wounds in the mucous membrane. The late results are good. Union is fibrous in most cases and leaves a permanent enlargement of the pelvic ring, so that subsequent labors are not infrequently normal. The gain in the true conjugate is about 0.75 cm., but there is a general increase in all dimensions which makes this diameter seem even larger. The operation is regarded in this clinic as quite ideal for pelves measuring over 7½ cm. and in all cases of spatial disproportion on the part of the pelvis or child where cesarean section is not absolutely indicated. In some clinics it is not unusual to do this operation and allow the woman to deliver spontaneously, but here we believe that the woman should be allowed to continue her labor until the soft parts have reached the maximum degree of expansion and then when the operation is performed the child may be extracted immediately. As the operation increases the anteroposterior diameter by 0.75 cm. it is an ideal operation in cases where forceps have failed and where it is certain that a little more room will allow the head to pass. Of course, in breech cases a delay of more than eight minutes is not possible with safety to the child, and hence the desirability of having the saw in place before extraction is begun.

As to operations, the subcutaneous method has a facile technic, more satisfactory, at least in this clinic, than the Bumm operation. A minor difficulty is met with occasionally in passing the needle behind the pubic bone, but this is obviated by passing the finger into the vagina where the end of the needle carrier can be controlled. The principal danger of pubiotomy comes from the proximity of the large veins that lie in the base of the bladder. The wounding of these veins results in the formation of a large hematoma, which appears under the vaginal mucosa and may require digital compression or packing for a short time to secure hemostasis. Occasionally—rarely—extraction tears take place in the vaginal wall up to and even through the pubiotomy wound. Suppuration may follow. Packing seems to be all that is necessary in these cases, and the results are generally quite satisfactory. Again, during extraction tears may take place in the vaginal walls up to the urethra or bladder and even through them. We had such an experience on the 19th of November last. The woman was a primipara, thirty-five years old, and the babe lay in an occipito-left anterior position; the pelvis was flat. After complete dilatation of the os the head beat against the pubic arch for four hours without engagement and the question of a cesarean operation or a pubiotomy was urgent. The latter was decided upon and performed. The babe delivered safely and easily with forceps. The same careful technic was observed which you have seen before you today. At the conclusion of the operation no laceration of the soft parts intraperitoneally was observed. At the end of twelve hours the woman was catheterized and 30 ounces of urine obtained. Twenty-four hours later the bladder began to leak through the vagina. Examination revealed a large opening, irregular in shape, which kept the bladder entirely drained. Whether this opening resulted from a tear during delivery which had been kept occluded by swelling of the soft parts and by the packing or whether it was due to necrosis of the tissue by the pressure of the child's head, we are unable to say. At any rate, a vesicovaginal fistula formed for which an operation will be necessary. It has been our experience that every primipara of thirty years of age or more in whom many pregnancies are not possible, and even the one which we are attending which has been a long time awaited, will prefer almost any form of pelvic or tissue mutilation rather than take a chance on the loss of the child. We agree with them in this, and find the pubiotomy a fairly beneficent operation for these cases. It saves many children.

We do not feel that pubiotomy in any way competes with cesarean section. It competes only with symphysiotomy, or the division of the pubic bones at the symphysis. In this clinic we feel that pubiotomy has been the safer. It makes a cleaner wound and the wound heals with fewer complications and generally with a permanent enlargement of the pelvis. Furthermore, the danger to the bladder and urethra during operation is distinctly less. The sole advantage of symphysiotomy is that it can be done with a scalpel, no saw or needle carrier being required.

As to the conditions for operation, we might say that the pelvis must be larger than 7½ cm. c. v., that the child should be living and viable and the soft parts distensible, and good surgical environment is prerequisite. The indication for this operation is that it should be preliminary to extraction by breech or forceps when disproportion exists between the head and the pelvis. To us it seems particularly indicated also in such malpositions of the head as face, brow, or posterior parietal bone.

Note.—The patient walked on the eighteenth day and left the hospital on the twenty-first.

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SURGICAL CLINICS OF CHICAGO

Volume 3 Number 5

CLINIC OF DR. DANIEL N. EISENDRATH

Cook County Hospital

CONGENITAL CYSTIC DISEASE OF THE KIDNEY: CONSIDERATION OF TUMORS OF THE KIDNEY IN GENERAL

Summary: Presentation of specimens, showing bilateral congenital cystic disease of the kidneys and cystic degeneration of the liver, removed at autopsy from the body of a patient who entered the hospital in a comatose condition and died a few hours later. Uremic coma. Discussion of the pathology, diagnosis, and treatment of congenital cystic kidneys, solitary cysts of the kidney and of the various forms of benign and malignant neoplasms of the kidney, with presentation of cases and specimens illustrating these conditions.

Here are the two kidneys and the liver removed at autopsy this morning from a patient who was admitted yesterday in a condition of uremic coma and who died a few hours later. My reason for presenting these specimens is that they illustrate a condition of the kidneys and liver with which every surgeon should be familiar.

The kidneys (Figs. 374, 375) illustrate the disease known as congenital cystic kidney, and the liver, a condition which is found in about 18 per cent. of such cases, viz., a similar conversion of the greater part of the liver into a series of cysts of varying size. That these changes are occasionally found at autopsy has been known for many years, but the necessity of recognizing the disease clinically dates back to a comparatively recent period.

Inspection of the kidneys reveals that the appearance on both sides is quite similar. The kidney has been converted into a mass of cysts varying in size from a pea to a cherry. The cyst wall is translucent and shows its yellow contents. The outline of the organ is preserved, although this type of tumor in the newborn infant may reach such a size as to fill the entire abdomen. A section presents a picture which is not found in any other disease of the kidney. Cysts are spread throughout the parenchyma and there is very little kidney tissue lying between. The cysts contain a clear yellow fluid resembling urine in every respect.

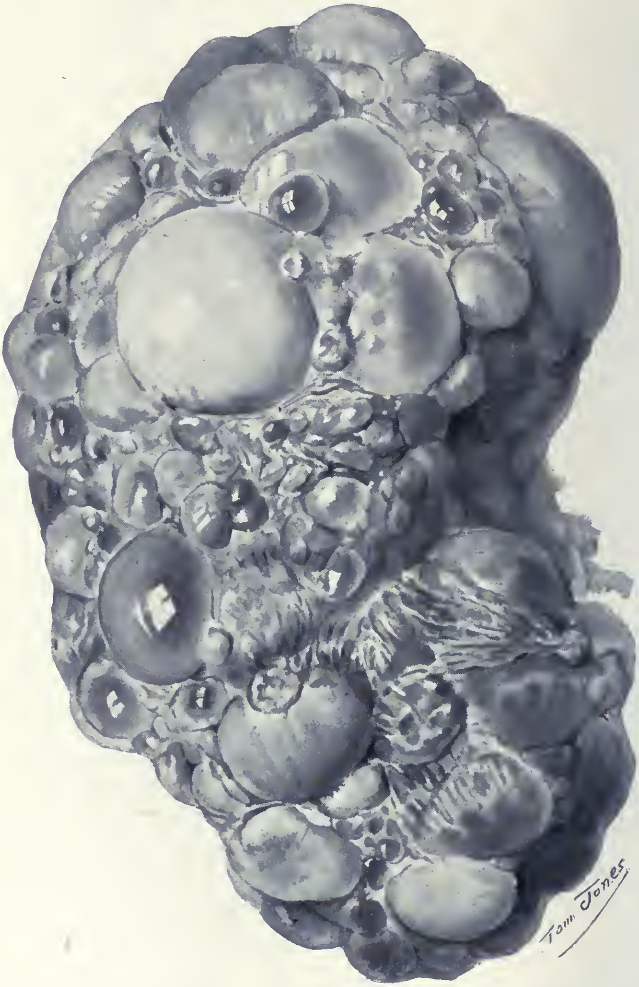

Fig. 374.—External appearance of specimen of congenital cystic kidney.

The uniformity of the changes in both kidneys is one of the most important features of the disease. Barnett has attempted to show that only one kidney may be involved, but the majority of others who have observed these cases feel confident that the disease is a bilateral one, although the degree of involvement

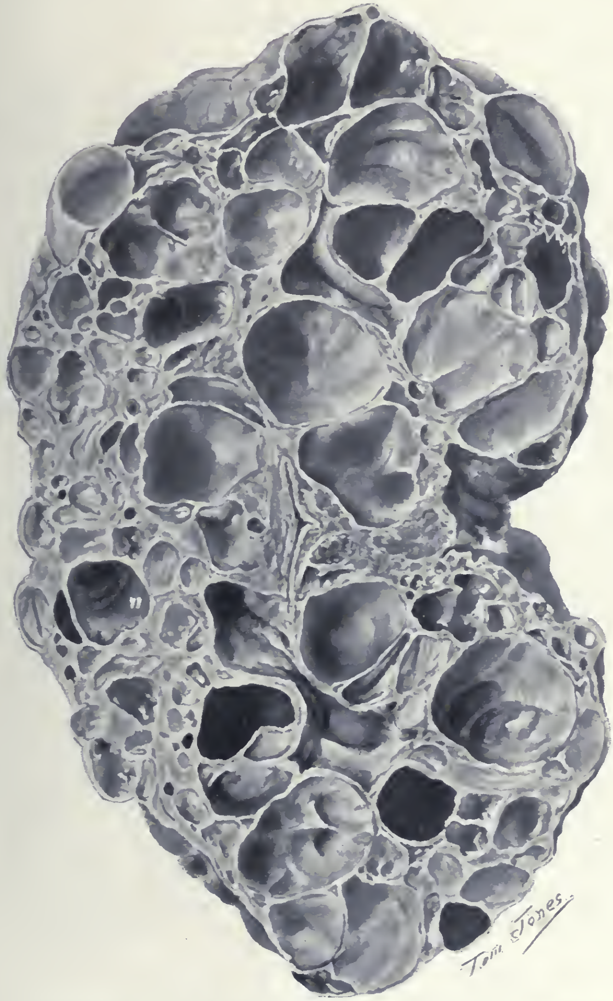

Fig. 375.—Appearance on longitudinal section of kidney showing changes characteristic of congenital cystic kidney.

may vary, *i. e.*, one kidney may be the seat of innumerable cysts, while the opposite one at the time of examination shows only a few. Sooner or later, however, the parenchyma of the less affected kidney becomes similarly replaced by cysts, so that it is not safe to regard the condition as a unilateral one. The liver shows a large number of cysts which, however, have not entirely replaced the parenchyma, as in the case of the kidney. The liver cysts are due to a blocking of the smaller bile-ducts.

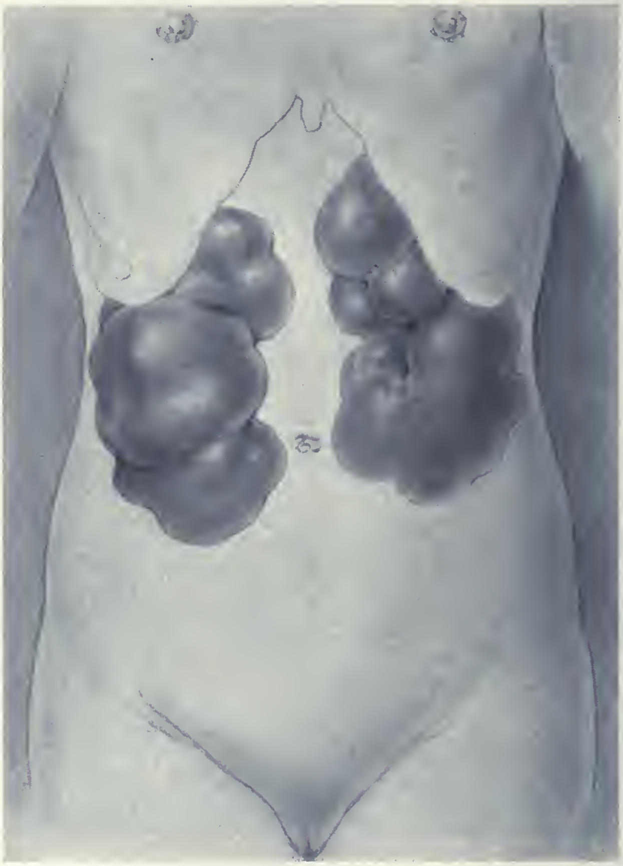

Fig. 376.—Findings on palpation of abdomen in one of author's cases of bilateral congenital cystic kidney (see text).

As to the etiology of this curious disease, the theory that the condition is due to a defect in development is now generally accepted. The tubular structures of the kidney, including the glomeruli, convoluted tubules, loops of Henle, and straight tubules, originate chiefly from the mesoderm of the embryo. The ureter, pelvis, calices, and an uncertain number of the straight tubules in the pyramids develop from a tubular process which originates from the Wolffian duct. In case this tubule growing from the Wolffian duct fails to connect with the primitive glomerular vesicle an obstruction occurs, resulting in cystic dilatation of the entire tubular system above the straight tubules. The extent of the process will depend on the number of tubules which fail to meet. At an early stage the cysts may be entirely confined to the medulla.

The process is a progressive one, and will, as a rule, manifest itself most commonly between the ages of forty and fifty. The average duration after the diagnosis is made is five to six years.

That the condition is present in a number of members of the same family and also that it is hereditary are well-recognized facts. I have seen a case in which five members of the same family had the disease. In the majority of cases the condition is clinically unilateral, but this is due to the fact that either the opposite kidney is but little involved or that one has not been able to palpate both kidneys. In women with thin flaccid abdominal walls it is not at all difficult to palpate the cysts in both kidneys (Fig. 376) at a comparatively early period.

Diagnosis.—That many cases of congenital cystic kidney pursue a latent course throughout life and are first seen with symptoms of uremic coma is shown by the comparative frequency with which such kidneys are found at autopsy in cases entering the hospital in a uremic condition, as our case (see Figs. 374, 375) did. During the latent period it is, of course, impossible to make a diagnosis. It is only when (*a*) one or both kidneys are sufficiently enlarged to be palpated, or (*b*) when the cysts encroach upon and rupture into the renal pelvis, or, finally, (*c*) when the parenchyma is sufficiently encroached upon as to interfere with the normal excretory function of the kidneys, that clinical pictures present themselves which make the careful observer suspect the possibility of this unusual condition being present. In other words, the most common clinical pictures under which congenital cystic kidneys appear are the following:

1. *Tumor.*—This may appear with or without pain. The latter is of a dull, aching character and is of a different character from the colicky pain due to passage of blood-clots observed during an attack of hematuria. I palpate both kidneys as a matter of routine in making a thorough urologic examination. By following this procedure I was able to make a diagnosis of bilateral cystic kidneys (see Fig. 376) in 2 cases where all the symptoms pointed to unilateral disease. One should pursue such a plan of bilateral palpation especially in cases in which the surface of the kidney is lobulated (see Fig. 376). To determine whether the tumor is a renal tumor one can resort to inflation of the colon (Figs. 377, 378) or, better still, do a pyelography (Fig. 379). Braasch[1] has found that

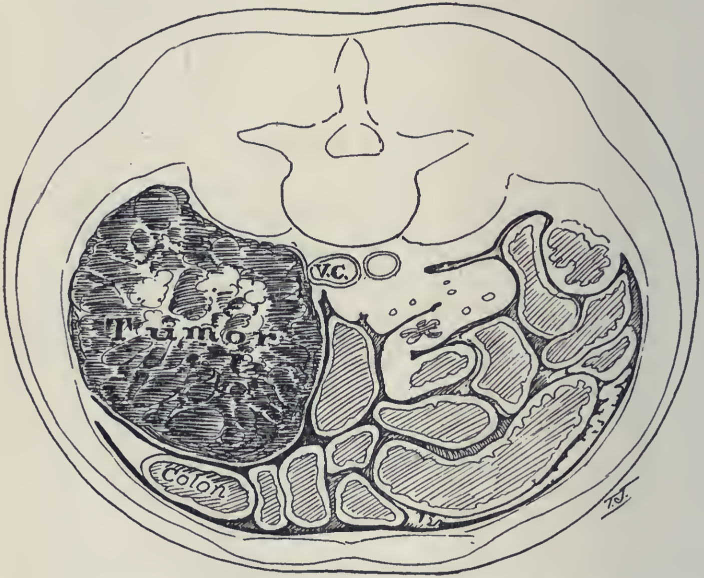

Fig. 377.—Cross-section of abdomen showing relation of renal tumor to colon and to vena cava.

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[1] Braasch, Surgery, Gynecology, and Obstetrics, 1916, 23, 697.

the outline of the renal pelvis is changed by the encroachment of the cysts. The evidence of abnormality is characterized by (*a*) flattening and obliteration of one of the major calices, (*b*) retraction and broadening of the various major calices, (*c*) elongation or rounding of the true pelvis, and (*d*) displacement of the pelvis from its usual position and angle.

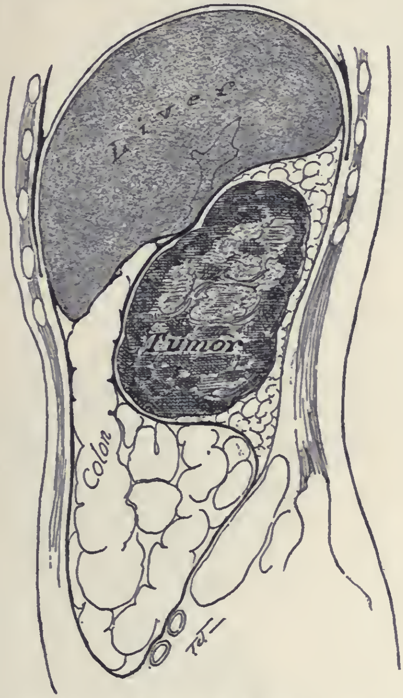

Fig. 378.—Sagittal section showing how kidney tumor displaces colon anteriorly and pushes it up against anterior abdominal wall.

2. *Hematuria.*—This may appear without previous symptoms, and at times even before a tumor can be palpated. It may be so severe as to cause death. As a rule, however, it is profuse and persists for several days to months. It may cease spontaneously and recur without apparent cause. The source of the hematuria (Fig. 380) must, of course, be sought for at once by cystoscopic examination, which will exclude the lower urinary tract. The blood, if it comes from the kidney, can be

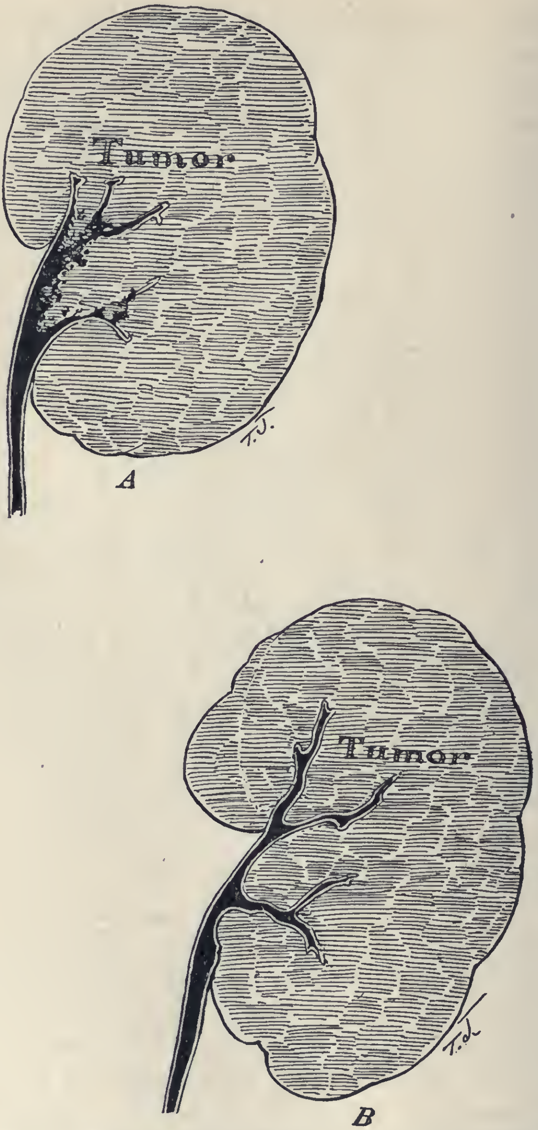

Fig. 379.—*A*, Diagrammatic illustration of manner in which a renal tumor encroaches upon the pelvis of the kidney. *B*, Diagram showing how normal contour of renal pelvis is changed by growth of tumor. This compression and change in outline of renal pelvis can be well demonstrated in pyelograms of renal tumors.

seen escaping from one or both ureteral orifices. Unless one has been able to palpate the cystic kidney on one or both sides of the abdomen, it is very difficult to differentiate hematuria due to a congenital cystic kidney from that due to a neoplasm of the renal pelvis or parenchyma. Pyelography is not of much aid, as the pictures seen in both conditions resemble each other greatly. It is not difficult to exclude essential hematuria (Fig. 380) as the source of the hemorrhage, because in this condition there is no change in the contour of the renal pelvis as seen in a pyelogram. Not infrequently hematuria is accompanied in these cases of congenital cystic kidney, as in neoplasms, by very severe colicky pains analogous to those seen in ureteral calculi, due to the passage of blood-clots from the renal pelvis to the bladder.

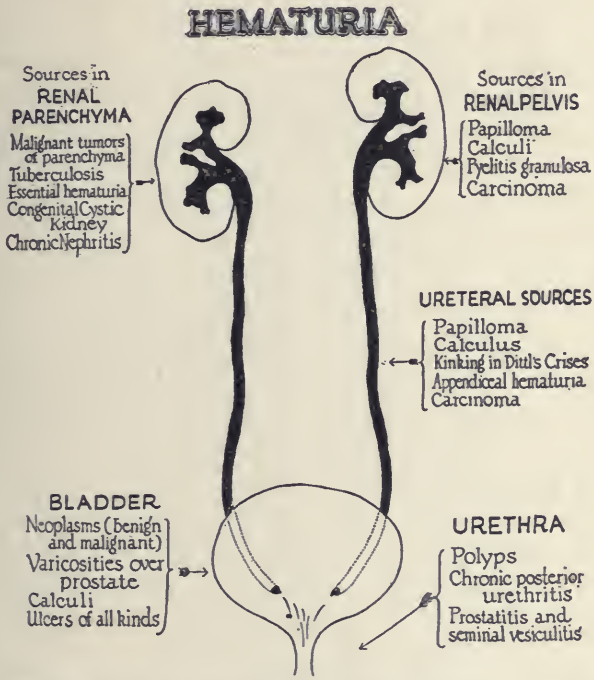

Fig. 380.—Chart showing sources of hematuria from upper and lower urinary tract.

3. *Renal Insufficiency Symptoms.*—These vary greatly in

degree according to the extent of encroachment of the cysts upon the adjacent renal parenchyma. When there is a history of one or more attacks of hematuria or the typical unilateral or bilateral nodulated enlargement of the kidney is present, the diagnosis is not very difficult. In the absence of such tumors and with the history of hematuria (which cystoscopy reveals as coming from the upper urinary tract) one must always think of congenital cystic kidney when symptoms of incipient or more advanced uremia appear.

If both hematuria and tumor are absent, the differentiation of this condition from chronic interstitial nephritis is exceedingly difficult. The urinary findings, high blood-pressure, and clinical symptoms of renal insufficiency may be quite similar. The heart is more apt to be enlarged in chronic nephritis, and this may be of some aid.

Treatment.—This is very unsatisfactory on account of the progressive character of the disease. Braasch is of the opinion that nephrectomy can be performed if the function of the remaining kidney is good, but I feel certain that this view is not shared by many other surgeons. Sooner or later the opposite kidney shows evidence of the same changes, and the improvement will be only temporary. The same is true of the Rovsing operation, which aims, through puncture of the cysts, to check the hematuria and to improve the secretory power of the kidney. There is recurrence of the symptoms after a period of amelioration due, no doubt, to the fact that other cysts appear in place of those which were punctured. It has been my policy in a number of these cases which I have seen in consultation to advise non-interference. There may be a difference in the degree of involvement of the two kidneys at the time the case is first seen. One kidney may be the seat of innumerable cysts (see Figs. 374, 375) and the other show scarcely any change by any of our modern diagnostic methods. Pathologists are unanimous in their opinion that although there may be an interval of years, the destruction of the less involved kidney is only a question of time, hence the decision not to operate on these cases, except to check hematuria or relieve threatening uremia, will, I feel confident, receive more and more support from year to year.

SOLITARY CYSTS OF THE KIDNEY

These develop in a normal kidney or one showing only slight changes (Fig. 381). A single unilocular cyst due to obstruction of one of the uriniferous tubules develops, which may attain the size of an orange or even larger. The cyst fluid has the same composition as urine, and is of a clear amber color. Usually there is only one cyst, but there may be two or three. As a rule, they are situated at either the upper or lower pole, but may develop in any portion of the organ. The condition differs from the one just described (congenital cystic kidney) in being unilateral

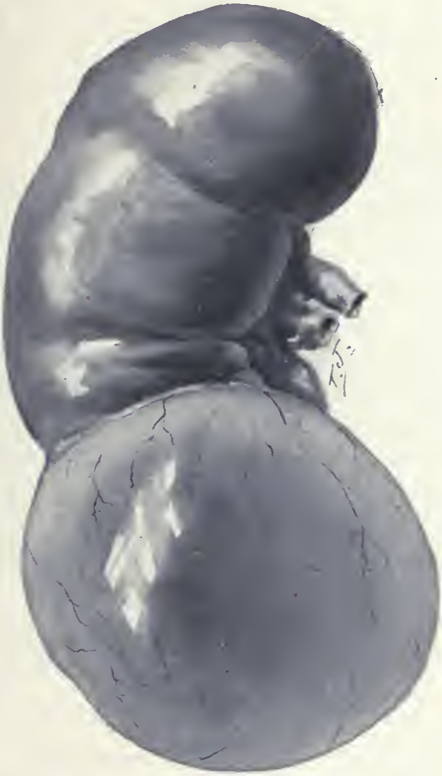

Fig. 381.—Solitary cyst of lower pole of kidney (after Cunningham).

The presence of this disease is not suspected until abdominal palpation reveals a tumor attached either to a normally placed or movable kidney. Such cysts occur most frequently in women, so that the question arises as to whether the tumor is an ovarian cyst, hydronephrosis, or an enlarged gall-bladder. Pyelography and ureteral catheterization are of great value in enabling one to differentiate the above-named conditions.

Resection of the cyst is to be preferred to nephrectomy, but it is not always possible to conserve the kidney if the cyst is very large.

TRUE NEOPLASMS

The two conditions of which I have just spoken—congenital cystic and solitary cystic disease of the kidney—are not neoplasms, although the former condition may cause death in a manner similar to that of a malignant growth. I will now present some specimens illustrating true neoplasms of the kidney proper (Figs. 382–384), renal pelvis, ureter, and adrenals.

One of the best classifications of kidney tumors is that of Binney,[1] which I shall follow in my remarks upon the diagnosis and treatment.

1. Tumors of kidney parenchyma:
    - A. Benign—1, Adenoma; 2, fibroma; 3, lipoma; 4, angioma.
    - B. Malignant—1, Hypernephroma; 2, carcinoma; 3, malignant cyst or papillary adenoma; 4, embryoma (including sarcoma); 5, teratoma.
2. Tumors of renal pelvis:
    - A. Benign—Papilloma.
    - B. Malignant—1, Papilloma; 2, squamous-celled carcinoma; 3, embryoma.
3. Tumors of the ureter.
4. Tumors of the adrenals.

Benign Tumors of the Parencyhma.—These are, as a rule, small and escape recognition clinically. Even a tumor in this class may, however, attain such a size as to resemble a malignant one (Fig. 382). This specimen was removed from a girl of four, whose only symptom was the presence of an abdominal tumor. This was comparatively easy to remove and had a firm capsule. Upon section, I was surprised to find that the tumor was a cystadenoma which had almost completely displaced the parenchyma.

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[1] Modern Urology, vol. 2, edited by Dr. Hugh Cabot.

Malignant Tumors of the Kidney Parenchyma.—The majority of tumors found in the adult are hypernephromata (see Fig. 383), while in children the sarcomata and mixed-cell tumors (embryomata) predominate.

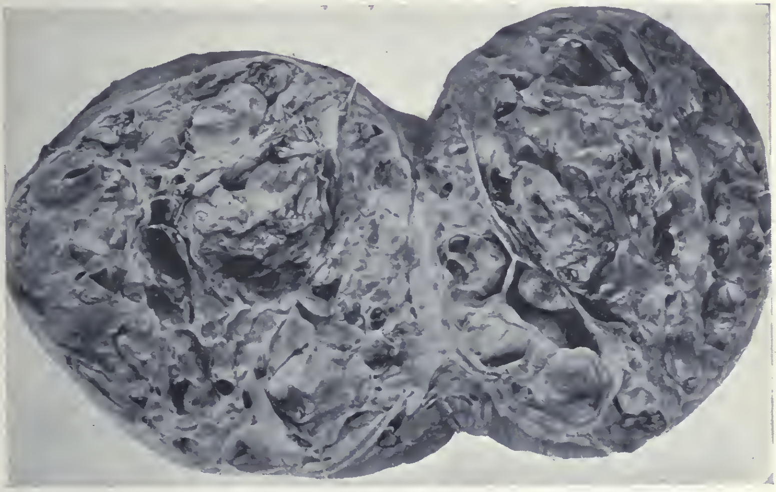

Fig. 382.—Cystadenoma of kidney removed from a child of four years simulating clinically a sarcoma of the kidney. Note remnant of kidney tissue at lower pole.

These two varieties of neoplasms are also of the greatest interest to the pathologist. The hypernephromata, according to the generally accepted opinion, represent aberrant adrenal tissue which proliferates in an atypical manner, but retains the peculiar arrangement and characteristics of the cells of the adrenal gland. The embryomata, on the other hand, represent a mixture of tissues found in the embryo. They are quite analogous to the mixed-cell tumors of the testis, and one may find all the elementary tissues in one microscopic section.

The other forms of malignant neoplasms do not differ greatly from those found in other viscera.

We are interested particularly in the clinical recognition and treatment of these tumors, so that I will now take up the various symptoms and the newer methods of diagnosis, such as pyelography and ureteral catheterization.

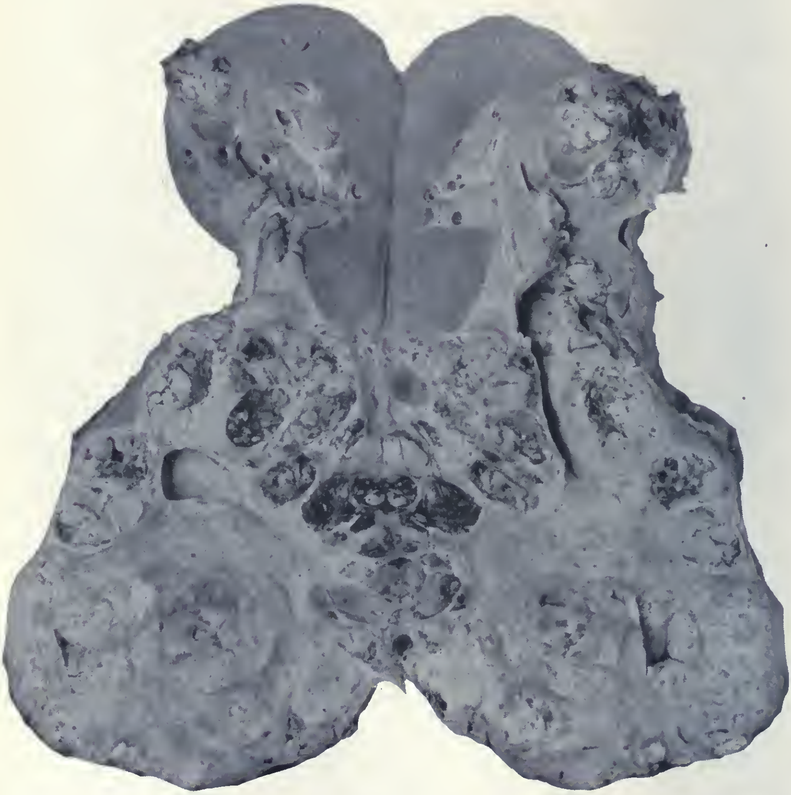

Fig. 383.—Hypernephroma of lower pole of kidney. (Dr. G. Kolischer's case.)

Hematuria.—This is the most frequent symptom of malignant tumors of the kidney, and may be the only one present during the entire clinical course of the case. The hematuria is seldom so slight as to be detected by microscopic examination alone. In the majority of cases the patient will give a history of one or more attacks of severe hematuria, which continued for possibly two months and then suddenly ceased, to recur with as few premonitory symptoms as those with which the initial attack had begun. In some cases large clots are passed in addition to the more diffuse mixture of blood and urine. The passage of these worm-like clots causes colicky pains resembling in every particular those due to the passage of ureteral calculi. Hematuria is predominantly a symptom of one form of malignant tumor in the adult—hypernephroma. This is due to the

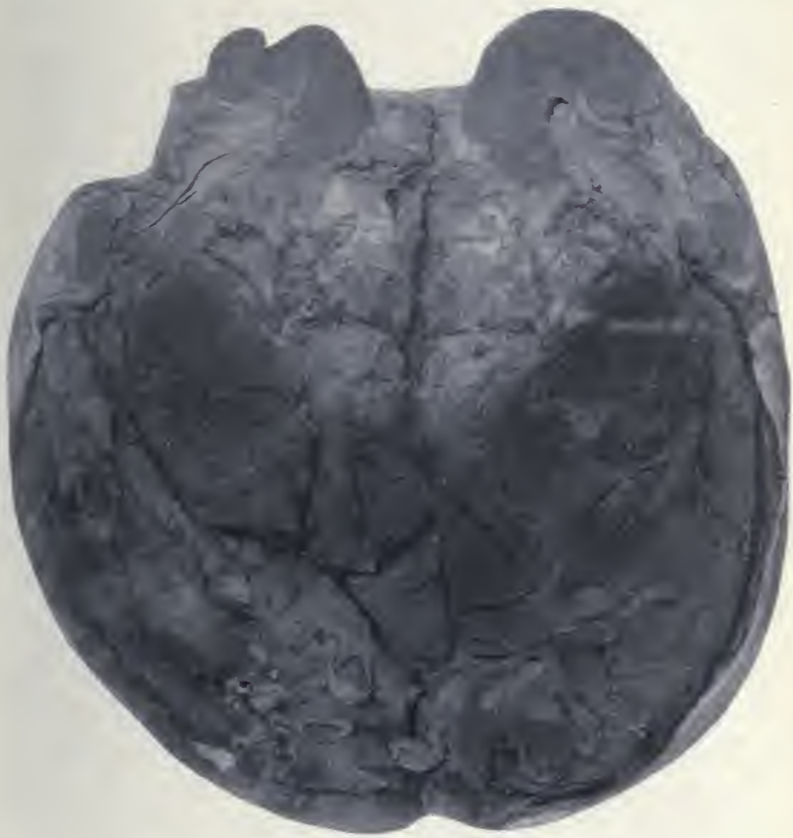

Fig. 384.—Hypernephroma of lower half of kidney. Two-thirds of the tumor tissue has been replaced by an enormous blood-clot. With each recurrence of hemorrhage patient had severe pain and symptoms of paralytic ileus.

fact that a portion of the tumor projects as a pedicled mass into the renal pelvis, so that the escape of blood into the lower urinary tract takes place very easily. I do not mean to convey the impression that hematuria is necessarily a symptom of every hypernephroma. I have seen a number of cases (see Fig. 384) in which there was clear urine from the beginning to the end of the case, there being compression of the renal pelvis without extension of the tumor into it, thus explaining the absence of hematuria. In the sarcomata of children, hematuria takes place in a very small proportion of the cases. Hematuria in adults may be so serious as to cause severe anemia and even death.

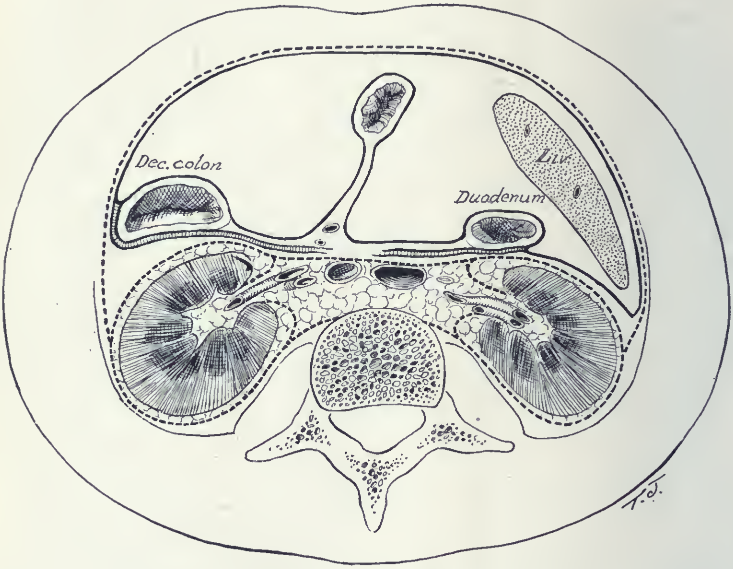

Fig. 385.—Cross-section of abdomen showing normal relations of kidney to duodenum and descending colon.

Tumor.—In children the presence of a tumor is practically the only symptom which calls attention to the possibility of a renal neoplasm, since hematuria is rarely seen. In children the tumor may reach enormous size, almost completely filling the abdomen. This is not the case in adults where, although the tumor attains considerable size, it never completely displaces all the abdominal viscera as it does in children. The presence of a large abdominal tumor in the region of the kidney, firm in consistency and lying behind the colon, is almost pathognomonic of a neoplasm in children. In adults the consistency of the tumor is very much the same as in children. On the right side the colon, as a rule (Fig. 385), lies immediately in front of the tumor, but on the left side it not infrequently happens that the colon lies above and external to the tumor.

Inflation of the colon is one of the best methods of determining the retroperitoneal character of the tumor. The diagnosis of a malignant neoplasm being the cause of the tumor can be established, as a rule, by a pyelogram which will show distortion and displacement of the normal renal pelvic shadow (see Fig. 379) quite similar in nature to the findings obtained by this method in congenital cystic kidney. As a rule, a malignant neoplasm of the kidney retains the general outlines of that organ until a comparatively advanced stage; it is a very fixed tumor and does not possess respiratory mobility owing to its fusion with adjacent structures, which takes place at a comparatively early period.

The presence of a tumor may be the only sign even in adults of a malignant neoplasm.

The differentiation of renal tumor from other abdominal tumors has been fully taken up in a previous lecture (Surgical Clinics of Chicago, August, 1919).

Pain.—This symptom varies greatly in intensity and character. As a rule, a dull, aching, constant pain over one or both kidneys, accompanied by hematuria or tumor, should lead to the suspicion of the presence of a malignant neoplasm. It is rare to have all three symptoms—hematuria, tumor, and pain—in the same patient. The pain, no doubt, is due to the increased intrarenal tension and is of different character from the colicky pains seen during the passage of clots in an attack of hematuria, and also differs from severe pains due to pressure on nerve trunks as a result of the local spread of a malignant neoplasm of the kidney.

The metastases of a malignant neoplasm of the parenchyma of the kidney tend to spread in one of three ways: either by continuity, thus involving the adjacent structures, or by the regional lymphatics to adjacent lymph-nodes (Fig. 386), or finally, through a continuation of the growth by way of the renal vein into the general circulation, resulting in metastases in the lungs, bones, and liver. It is characteristic of hypernephroma of the kidney to produce metastases in bones at a comparatively early period of its existence. In fact, one not infrequently makes the observation that the bony metastases occur before one even suspects the presence of a primary tumor in the kidney. I recall one case in which we operated on what was considered at the time a primary sarcoma of the femur, and it was not until the patient died several years later that we discovered the primary seat of trouble to be a hypernephroma. One should always suspect the presence of a malignant neoplasm of the kidney when

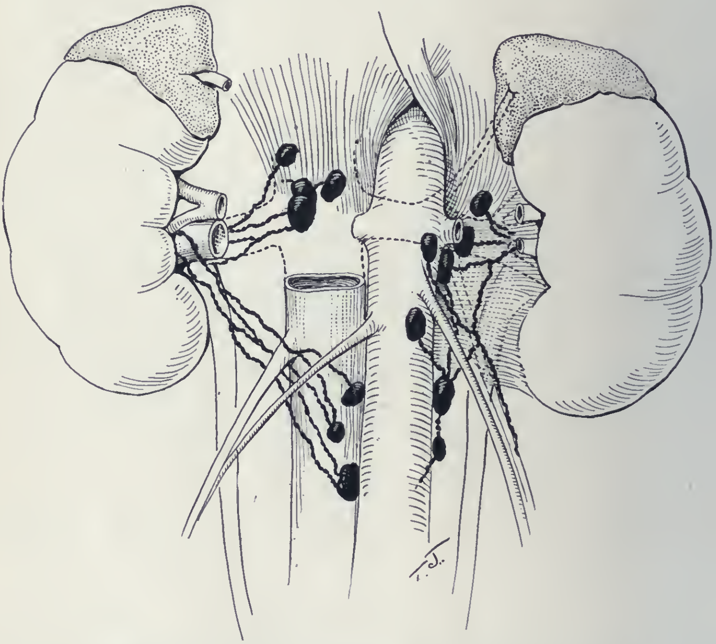

Fig. 386.—Lymphatic drainage of kidney. Note lymph-nodes lying on lateral and anterior aspects of vena cava and aorta.

a spontaneous fracture appears in one of the long bones. I have made it a routine practice in recent years to have a roentgenogram of the lungs taken before operating upon malignant tumors of the kidney or testes, because we frequently can detect in this manner the presence of metastatic tumors in the lung (Fig. 387) which would contraindicate the operation.

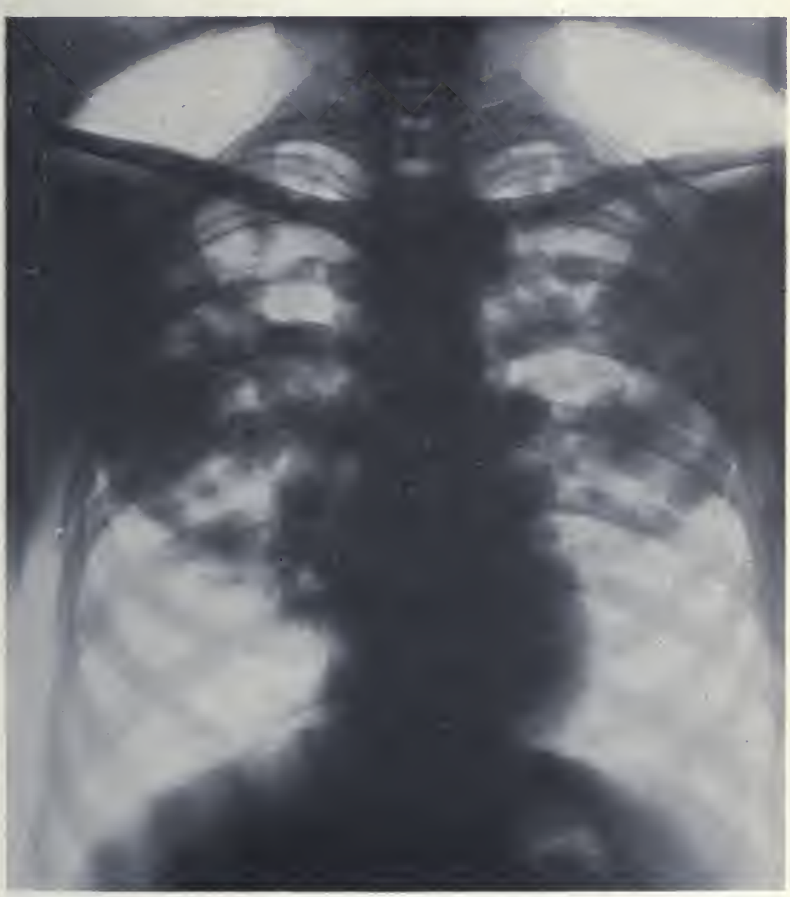

Fig. 387.—Roentgenogram showing shadows due to metastatic sarcoma of lung.

Fever is not a very frequent symptom of malignant neoplasms of the kidney. I have reported elsewhere a case which occurred in the practice of Doctors Lawrence and Harsha, in which an abdominal tumor in a child was thought to be an appendical abscess on account of the presence of high fever (Fig. 388). Israel found fever in 8.2 per cent. of 146 nephrectomies for malignant tumors of the kidney. It is a very important symptom if no others are present. It may be the initial symptom or may occur during an interval between attacks of hematuria, or it may be the predominant symptom.

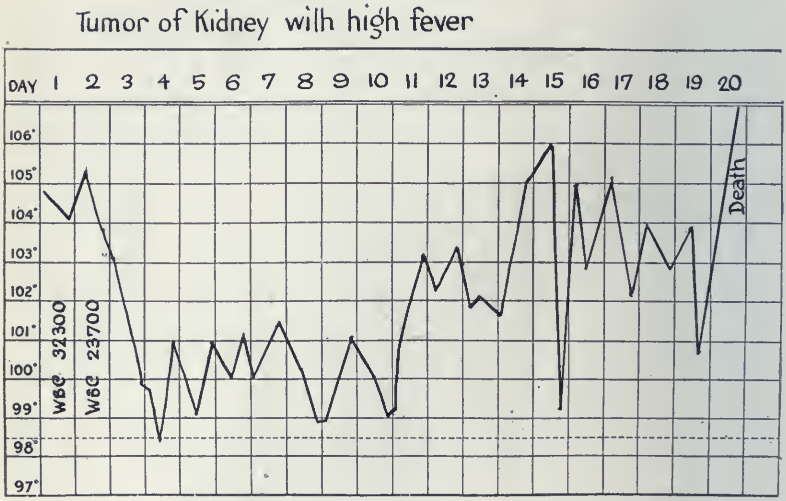

Fig. 388.—Temperature chart from case of sarcoma of the kidney in child of four, with high fever, simulating appendical abscess. (Case of Dr. Lawrence.)

The type of fever varies greatly. It may be of the remittent or intermittent type, or occur as a continuous fever following hematuria. It persists not infrequently when metastases are present, or recurs as new ones are formed, especially metastatic deposits in the lungs.

Reflex Ileus.—I have called attention elsewhere to the presence of reflex ileus as a symptom of various renal conditions, and reported a case (see Fig. 384) in which with every recurrence of hemorrhage into the hypernephroma the patient became enormously distended and showed all the symptoms of acute intestinal obstruction. This was due to the relation between the nerves of the kidney proper and those of the intestine.

Methods of Examination.—*Pyelography* has increased in importance as a method of diagnosis in malignant tumors of the kidney. The same may be said of ureteral catheterization, because we have found that there are many other causes (see Fig. 379) for hematuria besides malignant tumor of the kidney. Benign papilloma of the pelvis of the kidney (Fig. 389) may cause as severe bleeding as malignant tumor of the parenchyma. I have recently observed a case in consultation in which hematuria

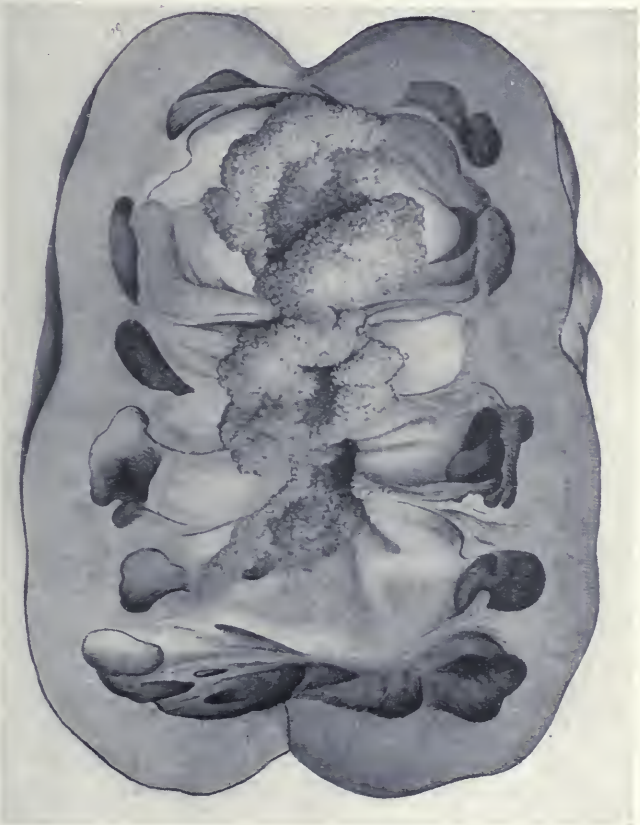

Fig. 389.—Multiple papillomata of renal pelvis (Albarran).

occurred without premonitory symptoms, and was of such severity, accompanied by the passage of large clots, as to make us certain that we were dealing with a malignant tumor. Operation, however, disclosed that the hemorrhage was due to a condition known as pyelitis granulosa, the result of severe infection accompanied by excessive, very vascular granulation tissue formation in the renal pelvis.

x-Ray Examination (*Exclusive of Pyelography*[1]).—This is only of advantage in exceptional cases in which there is calcification of a neoplasm as occasionally occurs in a hypernephroma or a calculus complicating neoplasm of the kidney. To determine, however, whether a given tumor is renal or not we can employ either the *x*-ray catheter, which will show where the renal pelvis is located in relation to the tumor, or, better still, make a pyelogram and determine the changes which a neoplasm will produce in the conformation and position of the renal pelvis and calices. I cannot urge too strongly the necessity in connection with an *x*-ray examination of the urinary tract in cases of suspected kidney tumor, of including the lungs (see Fig. 387), and if not contraindicated by the expense, also to have all the long bones examined before operation is considered.

Tumors of the Renal Pelvis, Ureters, and Adrenals.—Tumors of the renal pelvis may, like those of the kidney proper, be divided into benign and malignant. The only variety of practical importance in the former is the papilloma (see Fig. 389) which resembles in every way that of the bladder. This form of neoplasm does not occur very frequently and causes bleeding from the urinary tract which must be differentiated from all the other sources of hematuria (see Fig. 379). Like other forms of neoplasms of the renal pelvis and ureter, the tumor mass may cause obstruction of the lumen of the ureter resulting in hydronephrosis or hematonephrosis.

As in the case of vesical papillomata, these tumors of the renal pelvis undergo malignant changes and infiltrate the wall and invade the kidney and ureter.

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[1] Braasch (Text-book on Pyelography) states that there are five types of changes in neoplasms: (*a*) Retraction of the calices, (*b*) partial obliteration of the lumen of the calices, (*c*) irregular pelvic dilatation, (*d*) dilatation of the upper ureter, (*e*) abnormal position of the renal pelvis (lateral displacements).

Another variety of neoplasm of the renal pelvis resembles the epitheliomata seen on the more superficial mucous membranes, such as the mouth, etc. It is of the squamous-celled type, and not infrequently is associated with calculous formation, which is also true of the malignant type of papilloma of the renal pelvis.

Neoplasms of the Ureter.—Primary tumors of the ureter are very rare. Papillomata of the renal pelvis may become implanted on the mucous membrane of the ureter, just as a papilloma of the bladder will give rise to secondary growths by "vaccination" metastases upon other portions of the mucous membrane of the bladder.

Primary carcinoma of the ureter, although rare, may occur at any level. Secondary invasion of the ureter by primary neoplasms of adjacent structures is seen most frequently in malignant tumors of the uterus, ovaries, colon, and bladder.

Of most interest in connection with both primary and secondary neoplasms of the ureter is the obstruction to the urinary streams with hydro-ureter and hydronephrosis resulting therefrom.

Tumors of the Adrenals.—These are almost invariably of a malignant nature, the majority being hypernephromata which resemble the same variety of neoplasm of the kidney proper in their tendency to grow into the veins, and produce metastases in the lungs and bones at a comparatively early period. They occur with especial frequency in childhood.

Symptoms of Neoplasms of the Ureter and Adrenals.—Hematuria due to neoplasms of the ureter cannot be distinguished (see Fig. 379) from that due to those of the renal pelvis or parenchyma. Tumor formation is so rare that no reliance is to be placed upon this symptom. The same is true of pain, which is rarely present unless blood-clots are being passed, and then is not at all characteristic, since the same symptoms are often seen in tumors of the kidney proper during an attack of hematuria. When the ureter is obstructed the enlargement of the kidney will cause a palpable tumor. Pyelography is of great value in showing either a filling defect in the ureterogram or a considerable widening of the normal shadow due to dilatation of the ureter above the point of obstruction.

Tumors of the adrenals cannot be distinguished from those of the kidney proper unless two symptoms which are pathognomonic for adrenal tumors are present. These are: (*a*) bronzing of the skin, similar to that seen in Addison's disease, and (*b*) premature development of the hair and of the genitalia. I have seen these symptoms in a boy of three. A metastasis in one of the metatarsal bones was the first symptom. This tendency of both renal and adrenal neoplasms to produce early bone metastases has already been called to your attention. About six months after the appearance of the tumor in the foot the boy began to show deep bronzing of the skin and the body was covered with a diffuse growth of fine hair, without, however, any changes in the external genitalia.

Treatment of Tumors of the Kidney, Ureter, and Adrenals.—Benign tumors, with the exception of papillomata of the renal pelvis and ureter, seldom give rise to clinical symptoms. The treatment of malignant tumors is very unsatisfactory. This is due (*a*) to the fact that metastasis takes place very early and (*b*) to local conditions. The first I will not discuss any further, since the frequency of pulmonary and bony metastases is generally recognized. As to the local conditions, there are many adhesions of purely inflammatory nature, making it very difficult to separate the tumor from the liver, colon, and diaphragm on the right, and from the spleen and colon on the left side; adhesions to the vena cava on the right side may be so dense as to make it impossible to get into a line of cleavage. I have seen a portion of the wall of this vein stripped off in the effort to separate a hypernephroma. The adhesions to the aorta are less dense. The growth may completely envelop both the vena cava and aorta. Over the surface of these tumors there are usually a number of enormous veins and, in addition, many anomalous and accessory vessels.

The ordinary lumbar nephrectomy will seldom give sufficient exposure to deal in an adequate manner with the vessels at the pedicle or to remove the regional lymph-nodes around them. Transperitoneal nephrectomy is the only method which will permit of easy access to the pedicle. Every effort should be made to ligate the renal veins (Fig. 390) as close to the vena cava as possible so as to exclude an extension of the growth into the vein. It is advisable to separate the adrenal from the kidney with the greatest care because the adrenal is in very intimate relation (Albarran) to the kidney on one side and the vena cava on the other.

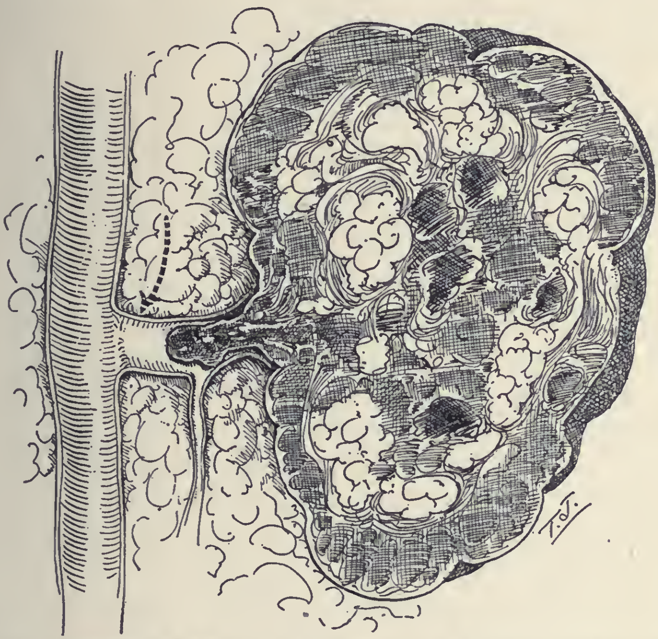

Fig. 390.—Longitudinal section of hypernephroma of kidney (diagrammatic) showing how tumor grows into renal vein.

The percentage of permanent cure in neoplasms of the upper urinary tract is very small because of the conditions of which I have spoken. Braasch found 10 per cent. cured at the end of five years. Recurrence within the first year is quite common. Sarcomata and embryomata in children and hypernephromata give the poorest prognosis of any of the various forms of kidney tumors.

CLINIC OF DR. ARTHUR DEAN BEVAN

Presbyterian Hospital

ABDOMINAL TUMORS—THREE CASES WITH UNUSUAL FEATURES

Summary: Case I.—An ovarian tumor disappearing and reappearing while under observation—explanation of the phenomenon—operation. Case II.—Bilateral ovarian cysts and uterine fibroid—hysterectomy. Case III.—Large fibroid simulating pregnancy—value of *x*-ray in differentiating pregnancy from tumor; phantom tumors.

The first patient I shall operate on this morning is a young woman of thirty-five who has been married a number of years. She has never had any children. She came to me about six weeks ago for examination, and I found that she had a large cystic tumor in the abdomen, probably an ovarian cyst. I examined the case with a good deal of care, and there could be no doubt that she had a large accumulation of fluid either in the cyst, or there was another vague possibility that might be considered in her case, and that was an encysted accumulation of peritoneal fluid as sometimes occurs, for instance, in tuberculous peritonitis. She had seen several physicians, and the question of a possible pregnancy had been discussed for some time as the abdomen began to enlarge. This, however, was eliminated by a good *x*-ray picture which showed no fetal skeleton—and from the size of the tumor, had it been a pregnancy, it would have been in the seventh or eighth month. Her general condition was excellent. There was apparently no urgency about the case, and I told her to come into the hospital as soon as she could conveniently arrange to do so within a week or ten days.

About two weeks later she came back to the office and said to me, "Doctor, the tumor has disappeared. My clothes are about 4 inches larger than they were before and I have lost

8 or 10 pounds in weight." I was very much surprised, and told her that I did not think it was possible that a tumor of that size could disappear so suddenly, but on putting her on the examining table and making another physical examination I found, to my great surprise, that she was correct in her statement and that apparently the tumor had disappeared completely. Even on bimanual examination through the vagina I could not make out any mass of any size. The examination, however, was not very satisfactory because she was very sensitive and rigid, but there was no question but that there had been a very marked change in her condition. I then told her that the only explanation that I could offer was that the tumor which had been there was an ovarian cyst, and that, as it had grown and become tense, it had ruptured and the fluid had been poured out into the general peritoneal cavity and had been absorbed, and that, if my surmise was correct, the tumor would reappear. I asked her to return again to my office two weeks later. This she did, and I found that I could outline very distinctly a tumor only about half the size of the tumor which she had when I first examined her. I questioned her very closely to find out if she had had any symptoms of rupture, any sense of pain or peritonitis, because I had met with a number of cases before of ruptured ovarian cyst, but they were accompanied with some evidence of aseptic peritonitis. She said, however, that she had had no pain at any time. I then sent her to the hospital, and she is here this morning for operation (Fig. 391).

We shall, of course, do this under ether anesthesia. She has been thoroughly prepared and you can see even at some distance the definite outline of a good-sized cyst extending a little above the umbilicus. The cyst is flat on percussion and is surrounded by a tympanitic area of intestine on both sides and above. I shall make first a rather short midline incision below the umbilicus and determine the condition. As I open the peritoneal cavity I come down to the cyst wall. This cyst wall is rather thick and whitish, and not, as I rather expected to find, a very thin-walled bluish colored cyst. I introduce a large trocar into the cyst and draw off 2 or 3 quarts of yellowish colored

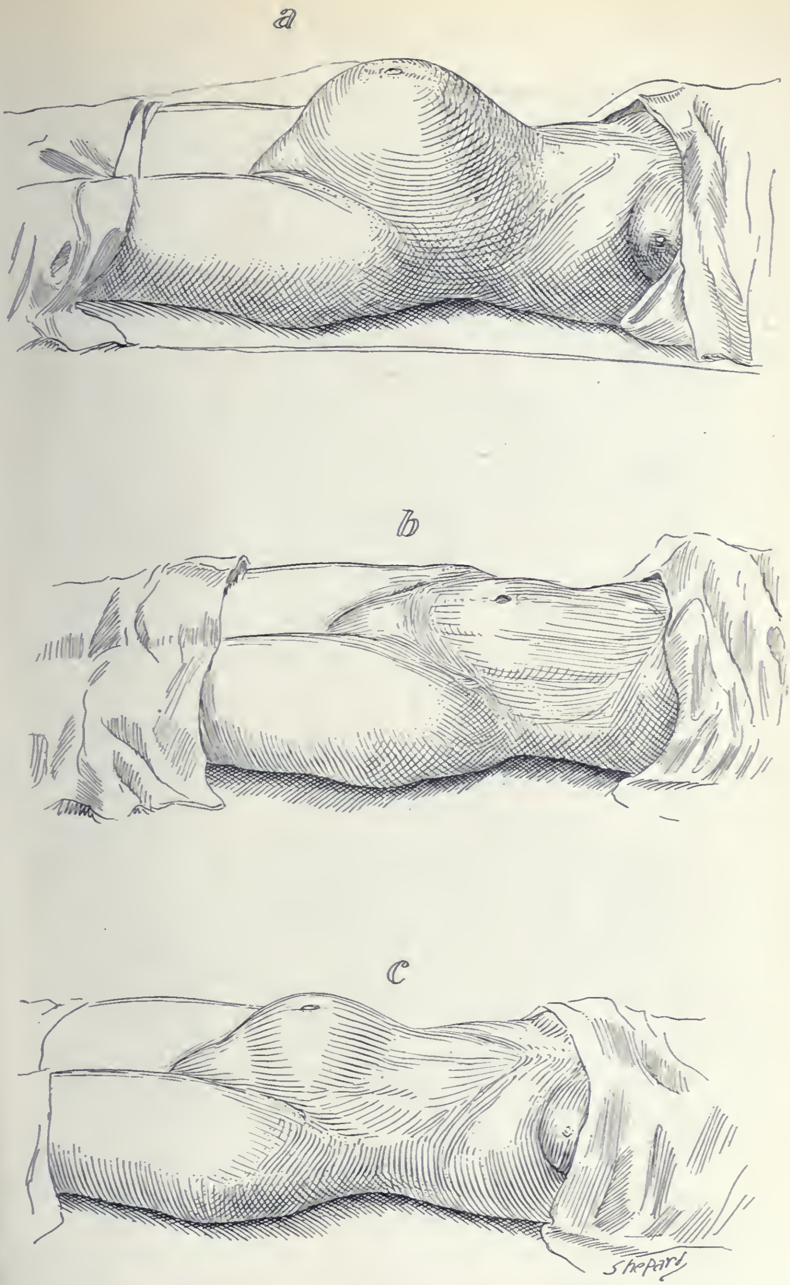

Fig. 391.—*a*, Appearance of abdomen at first examination; *b*, abdomen two weeks later; *c*, same abdomen two weeks later than (*b*) and just preceding operation.

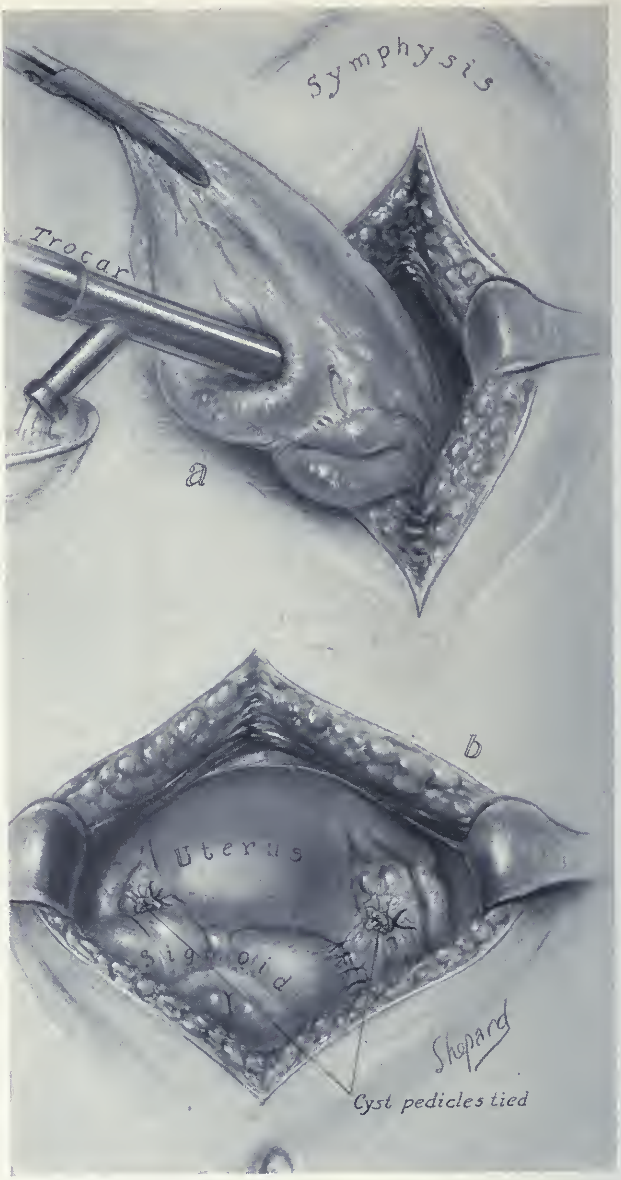

Fig. 392.—Operation: *a*, Cyst delivered through abdominal incision; contents being evacuated by means of trocar. *b*, Cyst removed; sigmoid stitched to raw areas on uterus and right broad ligament.

fluid. As this fluid is removed I gradually draw the collapsed cyst wall out through this comparatively small incision (Fig. 392). I find some fairly firm adhesions between the cyst wall and the peritoneum and culdesac, which, however, I can separate with my gloved finger. This large cyst springs from the left ovary and I ligate the pedicle, which is, as you see, a fairly broad one, about 2 inches in width. As I do this I expose the culdesac and find that the pelvic peritoneum is covered with some lymph and what appears like some old blood-clots. Evidently this was the result of the rupture of the cyst, and as I examine the cyst wall carefully I find that the part of the cyst that was in the culdesac is very thin, and I can see pretty distinctly the area at which the rupture occurred. Examining the right ovary, I find here a small cyst which I remove by ligating the pedicle in the same way. The pelvic peritoneum from which I have separated the cyst wall is rough and bleeding at points, and I believe that it will be wise to cover this raw surface by stitching the sigmoid down into the pelvis with a few catgut sutures, reducing in this way the chance of adhesions forming about the intestine (see Fig. 392). The wound is closed without drainage in the usual way.

I am glad of the opportunity of showing you this case because of its singular history. Rupture of ovarian cysts is not, of course, extremely rare, but such a complete disappearance of a very large tumor without any symptoms as occurred in this case is certainly very rare.

After-history.—The patient went on to a satisfactory recovery. For two or three days there was a good deal of vomiting, necessitating the use of stimulating enemas to relieve the disturbance and the gas-pains. These, however, rapidly disappeared and the patient went on to a complete recovery.

Case II.—The second patient upon whom I shall operate this morning also has a pelvic tumor, and one in which I am unable to make an absolute diagnosis as to its character.

This woman is forty years of age. She comes to me with the statement that the tumor, which she herself has been able to feel now for a number of months, has developed, she believes, within the last six or seven months. There is, as you see on examination, a large tumor in the lower abdomen on the right side extending well up above the umbilicus, the tumor apparently being about 7 or 8 inches in length and 4 or 5 inches in width. It is hard and firm and does not feel cystic. On the left side there is a similar tumor about half this size, which gives one a sense of fluctuation on careful examination. She has had no hemorrhages from the uterus such as we might expect from a fibroid. Her general health is good. She has had little in the way of pressure symptoms either on the bladder or the bowel. On making a bimanual examination the pelvis is so filled by the mass that I cannot outline the uterus or ovaries. I have been quite frank with her husband and said that I could not tell the character of the tumor, that it might be a fibroid or a multilocular cyst, and I have explained to her husband also the possibility of malignancy, although there is no clinical evidence upon which to base a diagnosis of this kind.

I shall make here the same sort of incision that I did in the first case, except I shall make it longer, extending up above the umbilicus, going to the left side of the umbilicus and well down to the symphysis. Opening the peritoneal cavity I find that the larger tumor on the right side is either a large fibroid bound down to the culdesac posteriorly, or it may be a pregnancy. The tumor on the left side is an ovarian cyst of the left ovary. I shall throw the table now in the Trendelenburg position and put in self-retaining abdominal retractors holding the lines of the incision widely apart. I shall first remove the ovarian cyst on the left side, and, as you see, I find a good deal of difficulty in doing this because it is so firmly bound down to the peritoneum. In separating these adhesions you see I have ruptured the cyst and that there is pouring out of it some black, thick material which I carefully mop out from the pelvis. Almost certainly this material is sterile and will not be the source of infection, but, as you see, I have the intestines well walled off by three large abdominal pads. I now ligate the pedicle of the ovarian tumor and then examine the right ovary. Here I find a long, sausage-shaped

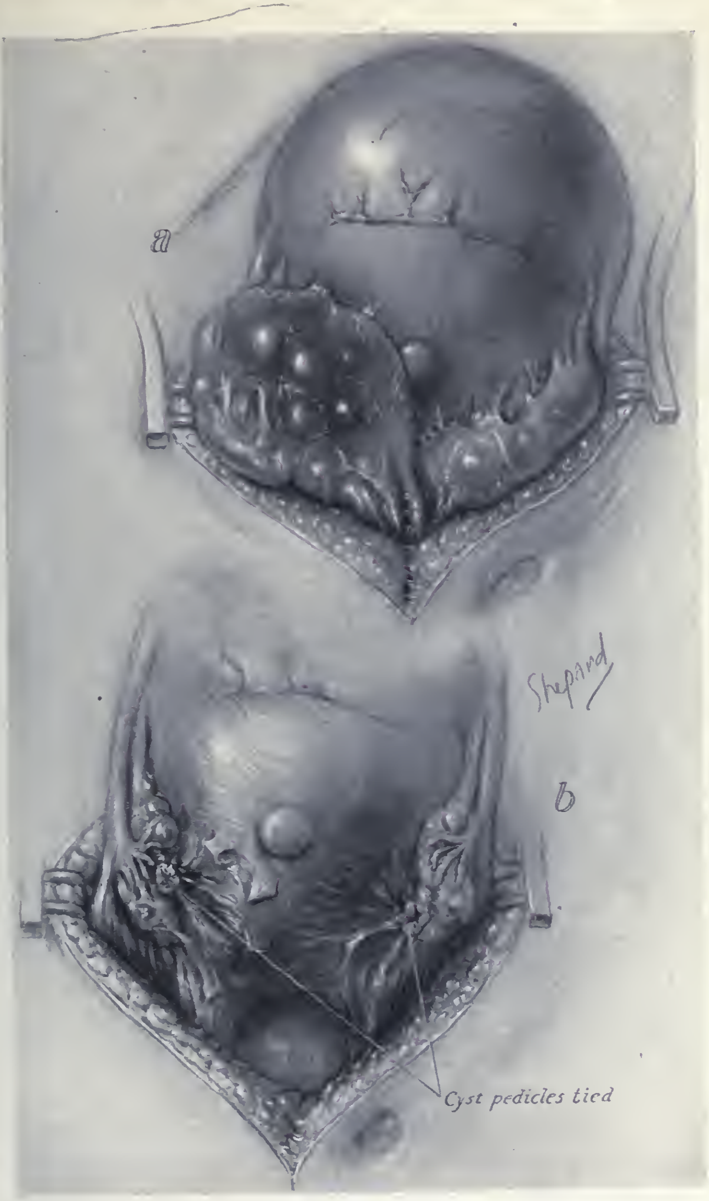

Fig. 393.—*a*, Uterus and bilateral ovarian cysts delivered through incision. *b*, Adhesions separated posteriorly, cysts removed, and pedicles ligated.

ovarian tumor bound down very firmly, and you notice that I rupture this cyst in removing it. The lower part of this right tumor is deeply bound down in the culdesac and attached to the rectum, and I remove this with the greatest possible care. The adhesions here are so firm that if I used any violence I would run great risk of tearing into the bowel. Fortunately, however, I am able to separate it without doing this. You will notice that I have also separated this large central mass, which is either a fibroid tumor or a pregnant uterus, from the culdesac and can now bring it well into view (Fig. 393, *a*, *b*). There is little probability of this being a pregnancy, but still there is a possibility. There have been no signs of pregnancy, and I have not hesitated to go on with the operation, because if it were a pregnancy the woman would have run great risk if she had been allowed to go on to term with these two large ovarian tumors obstructing the pelvis. Even if it were a pregnancy I should not hesitate to remove the uterus, because to my mind removal of these two adherent ovarian tumors, which I regarded as necessary, would make it very probable that she would abort and might have a serious time if this mass proved to be a pregnant uterus. I shall, therefore, proceed to remove this mass just above the cervix. I clamp first the uterine artery on the right side and then the one on the left, and with a knife I divide the peritoneum between the bladder and uterus, so that I can strip the bladder well forward, and I shall use this peritoneal flap to cover in the raw surface of the cervix (Fig. 394). I now divide the cervix with a sharp knife, making an anterior and posterior flap as one would do in an amputation, so that I can make a good closure. You will note that there is considerable bleeding from the divided cervix, requiring the use of artery clamps, in spite of the fact that we have completely controlled both uterine arteries. With a sharp needle and medium-sized catgut I close the cervix with four catgut sutures and then ligate the uterine artery on each side (Fig. 395, *a*, *b*). I have some considerable oozing in the raw area of the pelvic peritoneum in which I have separated these three masses. I pack this area with a dry abdominal pad and shall maintain a little pressure for five or six minutes. There is no spurting wound, but a dozen or more small bleeding surfaces.

The problem that now remains in this case is to cover in this raw surface so as to leave a clean and healthy peritoneum. I am going to do this by using the anterior flap of peritoneum which I made when I separated the uterus from the bladder and the sigmoid. I draw the sigmoid loop down into the culdesac gently without dislocating it to an extreme degree, and stitch,

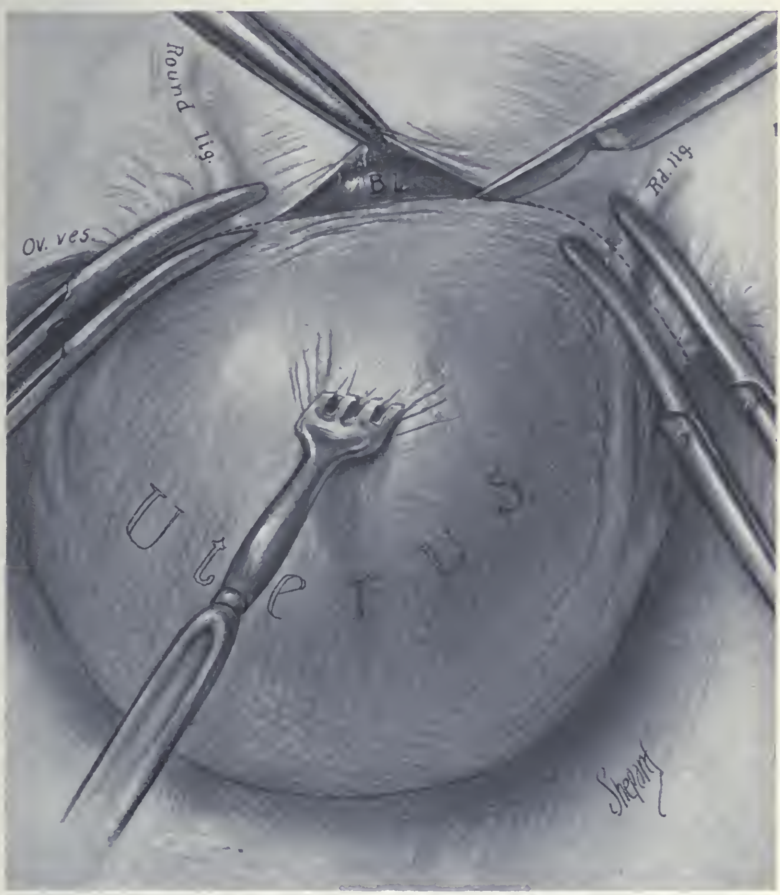

Fig. 394.—Ovarian vessels and round ligaments clamped; peritoneum incised between bladder and uterus.

with fine catgut, this sigmoid loop to my anterior flap, and you will notice that this leaves a perfectly clean peritoneal surface (Fig. 396, *a*, *b*). I shall not use any drainage in this case.

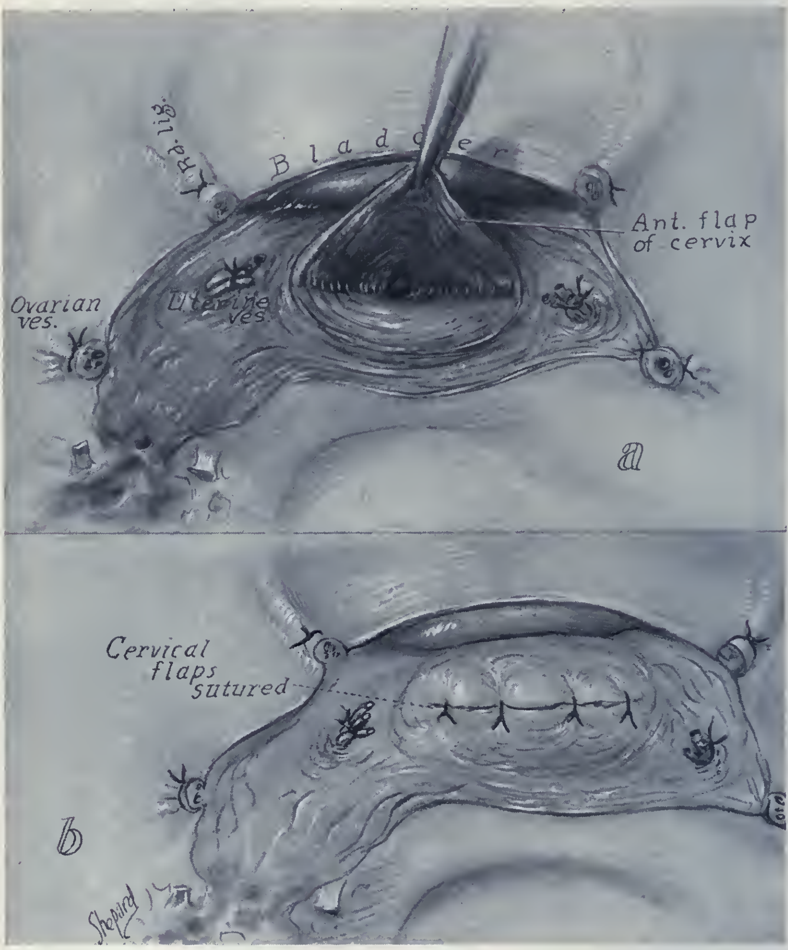

Fig. 395.—*a*, Uterus and appendages removed; vessels tied. *b*, Flaps of cervix brought together by interrupted sutures.

My sponges and pads have all been accounted for. I examine the appendix and find a good-sized concretion in the end of the appendix, and though I hesitate to add anything to this operation, I nevertheless think it wise to remove the appendix because of this large concretion. I do this in the usual way, invaginating

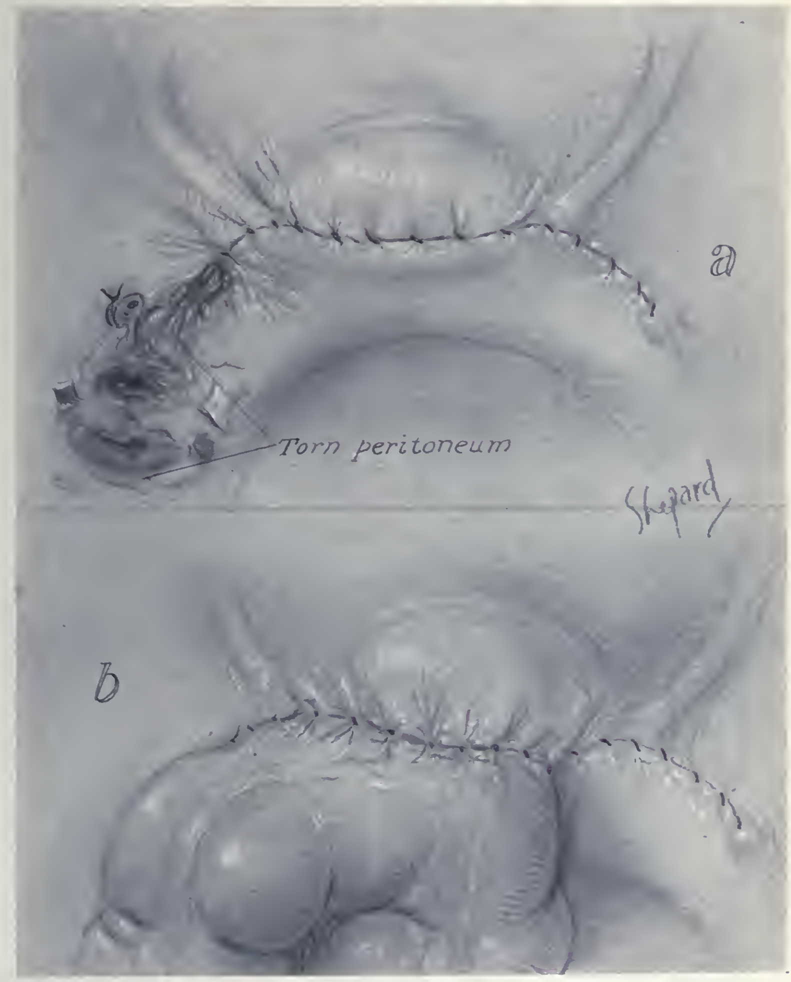

Fig. 396.—*a*, Peritoneum sutured over cervix and up to large denuded area on lateral pelvic wall. *b*, Sigmoid sutured over peritoneal defect on lateral pelvic wall.

the stump of the appendix and obtaining a good broad closure with purse-string sutures of Pagenstecher linen and a second purse-string suture over this of fine catgut. I examine the gall-bladder and find it is normal and contains no stones, and is compressible. We shall close the abdominal incision by our usual method of fine catgut for the peritoneum and through-and-through silkworm-gut for the rest of the layers, catgut for the sheath of the rectus, and fine black silk for the skin. The pads and sponges have been accounted for and the woman is in very good condition at the close of the operation.

After-history.—The patient went on to an uneventful recovery. Examination of the uterine mass removed showed that it was a large, soft, intramural fibroid. Examination of the ovarian cysts showed that they were benign.

CASE III.—I have another patient in the hospital which I want to show you today in connection with these two cases, a case that illustrates some of the difficulties that are met with in these abdominal tumors. This lady is one of my private patients, but she has kindly consented to allow me to present her case to you this morning.

She is a woman of thirty-eight who has been married for about fifteen years. She has never been pregnant. About ten months ago she ceased to menstruate and noticed that her abdomen gradually became larger. She was in hopes that she was pregnant, as she had always been very desirous of having children. As the abdomen gradually enlarged, she became quite confident that she was pregnant and was delighted with the prospect of having a child. She had few if any of the signs of pregnancy, though she had some morning vomiting. The breasts did not enlarge. Finally at the end of five or six months she was examined by her attending physician, who became doubtful as to her being pregnant. She was finally sent from an adjoining city to Chicago and came to consult me.

Vaginal examination showed a round mass quite consistent with a pregnant uterus of about seven months. I could not hear any fetal heart sounds, so I had a careful *x*-ray examination made and the plate showed no fetal skeleton, eliminating quite definitely the question of pregnancy in her case. I would like to emphasize the importance of this *x*-ray examination in these cases, because as I look back in my experience with cases of this kind in years gone by before we had the benefit of the *x*-ray, I can remember a number of cases where an *x*-ray examination would have been most helpful. We are in a position today to say with a good deal of certainty in these cases whether we have to deal with a large fibroid tumor which from physical examination may be consistent with being a pregnancy, or with a pregnancy itself from the *x*-ray findings (Fig. 397).

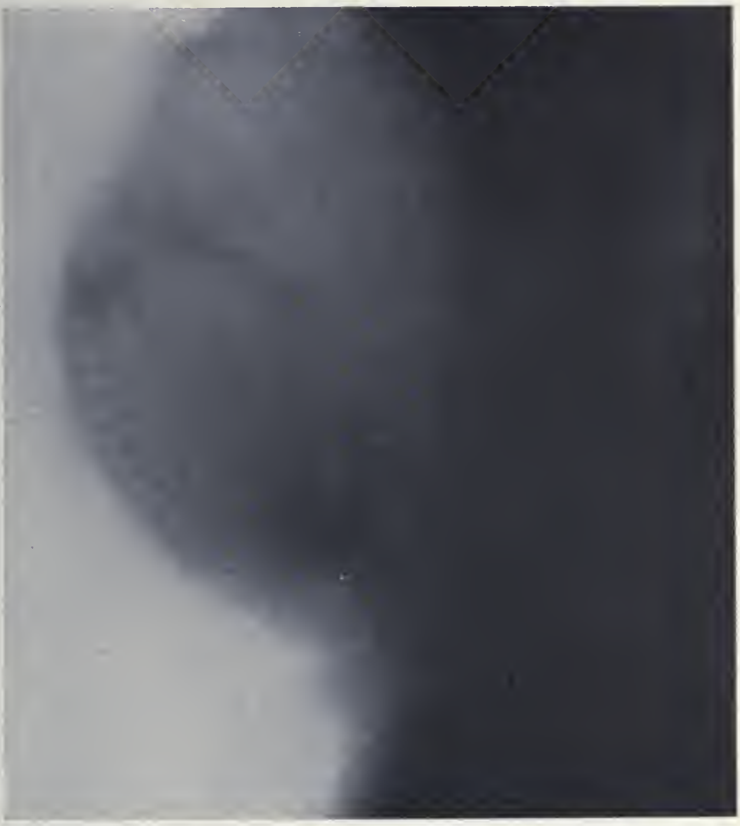

Fig. 397—*x*-Ray of pregnant uterus; demonstration of fetal skeleton—positive diagnosis of pregnancy.

After eliminating the question of pregnancy I advised, of course, an operation, and two weeks ago we operated upon this patient. I found, when I opened the peritoneal cavity, that the uterine mass was quite consistent with being a pregnant uterus as far as its shape and its feel was concerned, but I had the definite evidence of the *x*-ray to warrant my eliminating this possibility and proceeded at once to do a hysterectomy above the cervix. This was done without any special difficulty (see Fig. 395). On the left side of the large fibroid tumor, however, was a moderate-sized ovarian cyst which was removed. The right ovary was normal and was not removed. The woman has made an excellent recovery from the operation. Microscopic examination shows that we had to deal with a fibro-adenoma.

I want to take this opportunity of telling you the history of a somewhat similar case which I had to deal with before the days of the *x*-ray. A young woman of about thirty, a school-teacher, came to my service with a large abdominal tumor of very much the same character as the case which I have just shown you. I saw her in consultation with a very competent obstetrician who was much interested in the case. We examined all the facts and came to the conclusion that we had to deal with a fibroid tumor. The woman was not married and denied, on questioning, any possibility of a pregnancy in her case, so we determined to operate upon her and remove what we regarded clinically as a fibroid tumor.

My obstetric colleague was present at the operation. When I opened the abdominal cavity and brought the tumor into view, he looked it over carefully and said, "Bevan, that is a pregnancy and you must close the abdomen and let her go on to term." It certainly did look as though he were right. The uterine mass was one that was absolutely consistent with being a pregnancy of about seven or eight months. I followed his advice and made the operation purely exploratory.

The next day I talked to the young woman very frankly with my obstetric colleague, and we told her what we had found. She was very much outraged and very angry that we had not removed the tumor, stating with great emphasis that there was no possibility of her being pregnant. We therefore insisted upon her being kept under observation for another three months, which was done, and then, rather to my surprise, she was willing to come back and have me do the second operation. I say rather to my surprise because she felt very bitterly about the way we had handled her case.

At the second operation I also had my obstetric colleague present and another obstetrician of some note. On opening the peritoneal cavity for a second time the second obstetrician was quite positive in his statement that it was a pregnant uterus, but after my experience, knowing the length of time that the mass had existed and that there were no other evidences of pregnancy, I determined to do a hysterectomy. This was done, and after I had ligated the bleeding vessels I turned the closure of the wound over to an assistant, and the two obstetricians and myself then stood over this mass ready to make section of it. I must confess that all three of us were somewhat uncertain as to the possibility. In dividing it, however, we found it was a large soft intramural fibroid which developed in such a way as to spread the uterine musculature over the tumor just as it would in pregnancy. Of course in a case of this kind today we can, with careful x-ray examination, eliminate very definitely the possibility of pregnancy.

I want to relate to you also another incident that has been brought to my mind by a discussion of these cases, that is, a case which illustrates what is known in the literature as a "phantom tumor." Some years ago before we used the x-ray in these cases I was asked to go to a neighboring city to operate upon an ovarian tumor case. The case was that of a woman of about forty who had married about two years before. She did not become pregnant in the first year of her marriage. Then she apparently became pregnant. She ceased to menstruate and the abdomen enlarged. She convinced herself that she had all the signs of pregnancy. Her attending physician believed that she was pregnant. She made the baby clothes and all preparations for the childbirth. At the end of nine months the baby did not come. The tenth month, the eleventh month, and finally the twelfth month went by, and then the attending physician called in counsel, and they agreed that it was not a pregnancy, but an abdominal tumor, and I was sent for to operate on the case. Arriving in the town, I found the patient in the hospital and everything ready for the operation. A half-dozen local physicians were present to witness it. I examined the woman with a good deal of care. She was rather hysteric and the abdomen was quite rigid, and I was quite frank in stating to the physicians that I could not make a satisfactory examination without putting her under anesthesia, and that I was uncertain as to the condition. I therefore had her etherized and made a very thorough bimanual examination. I found absolutely nothing in the way of either a pregnancy or an abdominal tumor. The uterus was small and the ovaries and tubes perfectly normal, and we had to deal simply with a woman who ceased menstruating abruptly and then rapidly began to take on weight and had developed a large abdomen. I have always regarded the case as illustrating fairly well both the picture of imaginary pregnancy and phantom tumor.

ABSCESS OF THE PANCREAS

Summary: Abscess of pancreas developing one year after removal of gall-stones and drainage of gall-bladder in the presence of a pancreatic mass of unknown etiology; diagnosis—operative findings—dressings and post-operative management.

THE second patient I shall operate on this morning is a patient of Dr. Sippy's and of my own. A year ago, at the request of Dr. Sippy, I operated upon him for gall-stone disease, and my notes show that we found gall-stones in the gall-bladder and a large mass in the pancreas, and that we were uncertain whether this mass in the pancreas was a carcinoma or a pancreatitis. We have for a long time been removing the gall-bladder in most of our cases of cholelithiasis where the stones are limited to the gall-bladder. The exceptions we have made, however, were where we have had a large mass in the pancreas of unknown pathology and where we have felt that it was better to remove the stones and drain the gall-bladder, and indirectly the bile tracts, for a considerable period with the hope that that drainage might influence favorably the pancreatitis if the mass proved to be a pancreatitis. Because of that fact at our previous operation we did not remove the gall-bladder in this case, but simply removed the stones and drained. The patient made a good operative recovery from this operation. For a number of months he has been complaining of stomach distress. About two weeks ago he had what appeared to be, from his history, a rather sharp hemorrhage from the intestines, with tarry stools, without vomiting any blood whatever. He at once came back to the hospital and placed himself under Dr. Sippy's care. Dr. Sippy found a mass in the upper abdomen apparently about the size of an egg, deeply situated, below the ensiform and a little to the right. The patient had some temperature and a sharp increase in his leukocyte count and was kept under observation for several days. The mass gradually increased in size, and with it the patient developed rather sharp abdominal pain coming on in paroxysms.

I saw the case yesterday with Dr. Sippy, and we concluded that the most probable diagnosis was a perigastric abscess, and on account of the hemorrhage from the bowel that it might be an ulcer or a carcinoma. On making the physical examination we found that this mass pulsated almost as though it were an aneurysm of the abdominal aorta, but we came to the conclusion that it was a transmitted pulsation. Our clinical diagnosis is a perigastric abscess, and we have decided to explore and drain the abscess if one is found. The patient's temperature this morning is 103° F., with a leukocyte count of 20,000.

The patient is now etherized and we make an incision in the midline from the ensiform to the umbilicus. On opening the peritoneal cavity I find a free peritoneal cavity. The stomach, however, is bound down to a large mass which is evidently behind it. The gastrohepatic omentum is covered with a layer of lymph. The liver and lesser curvature of the stomach are widely separated and a globular mass presents itself here between the liver and the stomach. This mass fluctuates. I shall take an exploring needle and an aspirating syringe and see what the contents of the mass are. Pushing the needle into the mass for a short distance I find it enters a cavity (Fig. 398, *a*). On drawing back the piston, the syringe, as you see, fills up with cloudy, yellowish fluid, something like the thin pus that one finds frequently in empyema. I take a pair of closed artery forceps and follow the track of the needle, then gently open the forceps and make a hole about 1 inch in length in the gastrohepatic omentum, and, as you see, there wells out a large amount, probably a pint, of pus (Fig. 398, *b*), at first thin and watery, and as I mop it out at the bottom of the abscess there is some rather thick, creamy pus. Unfortunately, I have evidently injured a good-sized vessel in the gastrohepatic omentum, as it bleeds quite freely. I clamp the sides of the opening and control this bleeding, but apparently the lining membrane of the abscess also bleeds fairly profusely, and it is necessary for me to pack this with iodoform gauze in order to control the hemorrhage, which is rather sharp. I finally succeed in doing this. I introduce, as you will notice, also a good-sized cigarette drain into the

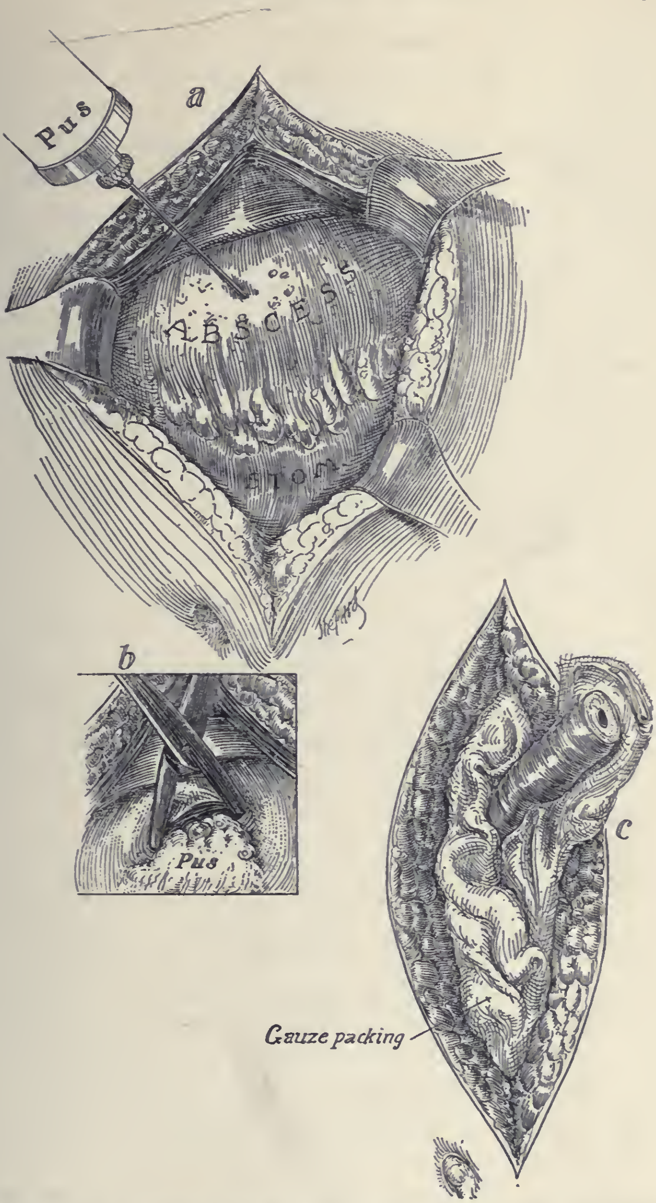

Fig. 398.—*a*, Abscess exposed and diagnosis confirmed by aspiration. *b*, Pus evacuated by spreading forceps inserted along tract of aspirating needle. *c*, Large gauze pack and cigarette drain extending to bottom of bleeding cavity.

abscess cavity and pack the gauze around it (Fig. 398, *c*). There is in addition to this abscess a large mass, which is apparently a large, swollen, edematous pancreas. Our diagnosis now is this—gall-bladder disease, infection of the bile tracts, and secondary infection of the pancreas, and finally the development of this abscess of the pancreas. We cannot absolutely exclude carcinoma, but we cannot find any carcinoma of the stomach or duodenum or any ulcer of the stomach or duodenum.

I shall now close the external abdominal wall, leaving, of course, a large gauze packing and a cigarette drain at the upper angle of the wound. I am going to give this patient $\frac{1}{4}$ grain of morphin just as soon as he comes out of the ether, because I am sure he will have a good deal of pain, and the morphin will check his restlessness and check the tendency to bleeding. One must think of the possibility of the rather free hemorrhage that occurred in this case as being associated with a pancreatitis, because we know how frequently we have hemorrhage in these pancreatic cases. The prognosis, it seems to me, is exceptionally grave, though by no means hopeless. The pads and sponges have been accounted for and the patient is in fairly good condition. We shall give him normal salt solution by rectum and keep him fairly under the control of the morphin, as I have already stated.

After-history.—There was very excessive bloody oozing from the wound, most of it being wound secretion and not blood, but fairly deeply blood stained. The iodoform gauze packing was gradually removed until it was all out by the fifth day. The patient's general condition was surprisingly good following operation. He had little or no shock and no vomiting, and went on to a good operative recovery.

The absolute diagnosis in this case is uncertain, and it may be a question that time alone can determine. If the case goes on to a complete recovery without developing any evidence of carcinoma we will be confirmed in our diagnosis of pancreatitis. If, on the other hand, there is a carcinoma plus that condition, he will gradually go down hill and succumb to the disease.

A CASE OF ULCERATING CARCINOMA OF THE BREAST

Summary: Technic of surgical management of large, sloughing breast tumor; importance of sterilizing mass before operation; dangers of radical amputation in such cases; postoperative treatment.

The second patient I shall operate upon this morning is a relative of one of my former house surgeons, a woman who lives out in the country, and who came to see my former assistant yesterday in a very shocking condition. She noticed, about eight months ago, a hard lump in her left breast and she made the serious mistake that is unfortunately so often made by patients of this kind—she concealed any knowledge of the trouble from her husband and did not consult any physician. The mass continued to grow and within the last six weeks it has broken down and ulcerated and bled quite profusely, and is now this large cauliflower carcinoma about 4 inches in its long diameter and about 3 inches in the short diameter, and projects out above the breast, as you notice, fully 1½ inches. The woman says that her general health is fairly good, but examination shows that her hemoglobin is only 53 per cent., and examination of the axilla shows some axillary involvement.

I am glad of the opportunity of presenting this case to you because it is an example of a group of cases that come to us and demand relief. It is quite clear that there is little or no hope of permanantly curing this woman of carcinoma, and still we must admit that there is a small possibility of doing this. This foul, ulcerating, bleeding cauliflower mass is, of course, a source of great distress and pain, of odor, and hemorrhage. I shall simply tell this woman's husband that there is little prospect of a permanant cure, but that we shall give her the benefit of a palliative operation. Personally I unhesitatingly decide to give her the benefit of an operation which I recognize as palliative. I shall proceed to follow out a plan which we have adopted in this clinic in these cases. I shall make no effort to prepare this field of operation before the patient is anesthetized, because the mere touching of this cauliflower mass produces a very copious hemorrhage, and it would be very difficult to sterilize this field as we do in the ordinary breast amputation. I shall, therefore, first completely anesthetize the patient and then sterilize the field by a technic which I especially want to call your attention to. The patient is now completely anesthetized. The ulcerating mass is covered with an old dirty, foul dressing, and the mass bleeds very readily when we attempt to remove this dressing. I shall, therefore, take an electric cautery and cauterize this mass as I remove the dressing, putting this flat electric cautery on the bleeding surface, having the current turned on so as to produce simply a brown heat, and cauterize very carefully (Fig. 399). As you see, it takes ten or twelve minutes to cover this entire bleeding surface and check all the hemorrhage. I practically cook the outer surface of the mass so as to control all the bleeding, and at the same time to destroy all the bacteria that are on the surface. Now instead of attempting to shave this field and clean it up with soap, water, and alcohol, as we ordinarily do in breast amputations, I shall prepare the field with tincture of iodin, using tincture of iodin very freely, and covering the whole left side of the chest with tincture of iodin, and then in two or three minutes, after this is dry, I put on a second coat, painting it very thoroughly and putting the iodin in the clefts and fissures that exist between the cauliflower mass and skin about the growth, and covering also the ulcerating area with iodin.

I shall now proceed to remove the breast and this ulcerating mass, but shall not do the radical operation in the sense of removing the pectoralis major or cleaning out the axilla, the object of my operation being to get rid of this great ulcerating, bleeding mass. You will notice that the long axis of the growth runs about parallel with the ribs, and I shall have to plan an incision that will enable me to remove the entire breast and at the same time allow me to save enough integument to make a complete closure, as I am very desirious of obtaining a complete closure, leaving no open area after the operation. I shall,

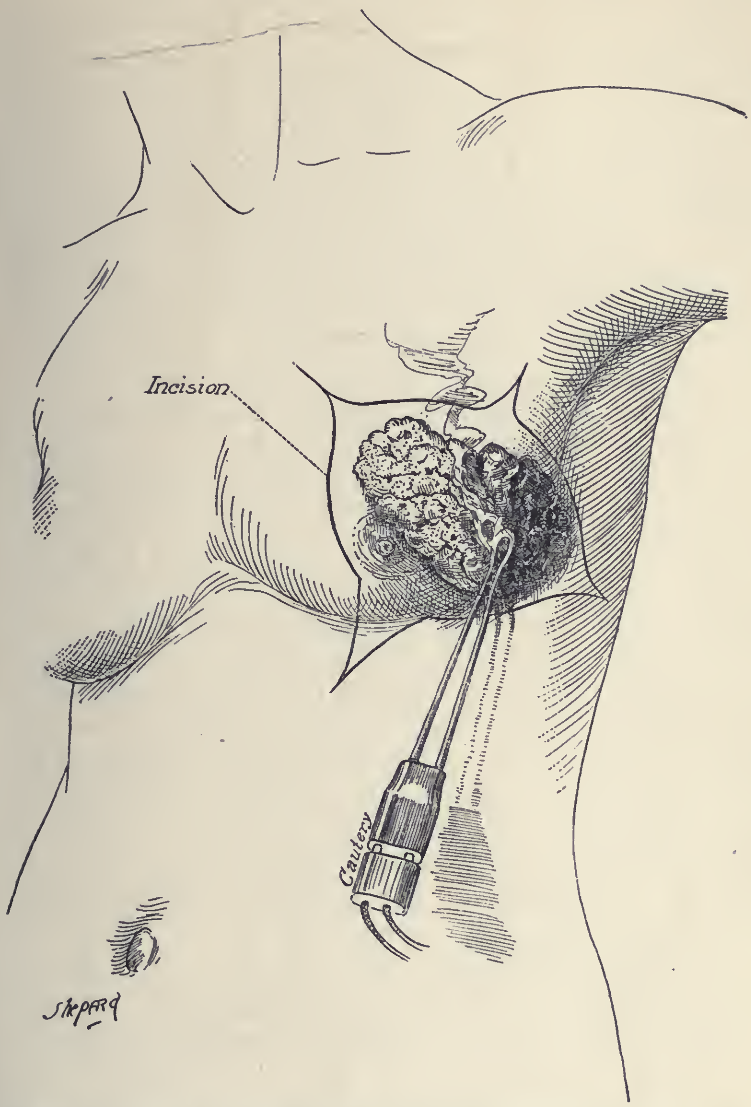

Fig. 399.—Surface of tumor cauterized to stop hemorrhage and destroy bacteria. Note lines of proposed incisions.

therefore, make an atypical incision, encircling the entire tumor first with an elliptical incision running rather parallel with the fifth rib, going above and below the tumor, and then adding to this a V-shaped incision above and a second V-shaped incision below, so I can turn back four flaps of integument and remove the entire breast with this cauliflower mass (Fig. 400, *a*).

You will notice that in making this dissection we have a very free amount of bleeding, as one might expect with this condition. The bleeding points are all controlled with artery forceps. In doing the operation I am careful to avoid touching the ulcerating mass, and make my four flaps by undermining the integument of each, going almost to the sternum in the midline and well outside of the pectoral muscle on the outer side. I now remove the entire breast containing the tumor. Because of the fact that this operation is done with this foul and ulcerating mass in the center, I am not absolutely sure of my asepsis, and shall, therefore, sterilize this field before closing with peroxid of hydrogen and with 50 per cent. alcohol. I believe that these agents are of definite service in an operation of this kind. I now bring my four flaps together, as you will notice (Fig. 400, *b*). I am enabled to close the entire open area with these skin-flaps and, fortunately, without any tension. I believe that this woman will go on to a good recovery from this operation, and then we shall have to consider one of two propositions—either the simple handling of the case from that time on with *x*-ray treatment, or else, after wound healing is complete, the making of a radical operation, removing the pectoralis major and axillary contents and then follow with the *x*-ray. This, of course, could even be done after we had obtained perfect wound healing with safety from the possibility of infection.

I particularly want to call your attention to the plan which we have adopted here and urge upon you its value. I do this because we have had a number of unfortunate experiences in cases of this kind which have taught us these lessons. I have, for instance, had the misfortune in doing a radical breast amputation in the presence of a large foul, ulcerating mass to have a resulting severe infection with secondary hemorrhage from the axillary vessels which proved fatal. I have several times had the misfortune to have an infection follow an attempt at radical operation in the presence of an ulcerating, profuse carcinoma.

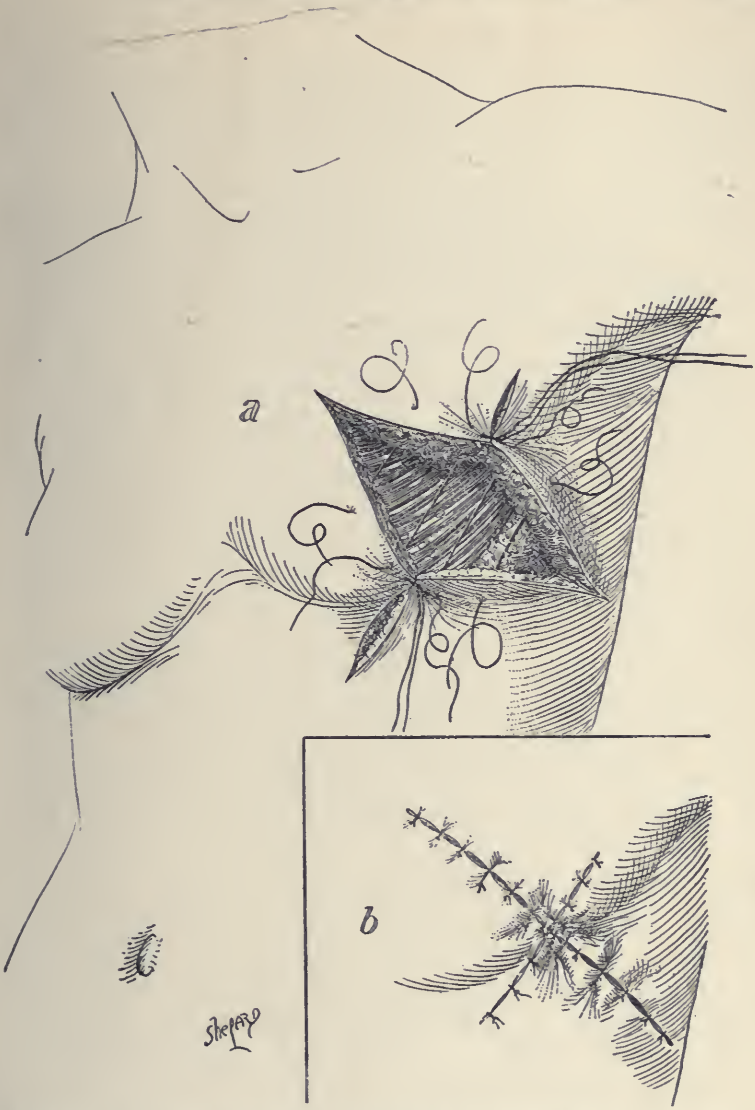

Fig. 400.—*a*, Tumor resected. Stay sutures of silkworm-gut placed; *b*, wound completely closed.

The end-results in cases of this kind are, of course, uncertain. The chances are, however, if we follow this case up thoroughly with *x*-ray that the woman will be saved from the trials of any further ulcerating process, and that she will die eventually of general carcinomatosis, with much less distress and far greater comfort than she would have done if we had not given her the benefit of this palliative operation.

After-history.—Before operation the patient was very loathe to have anything done in a surgical way, and she was rather forced into it by the advice of her relative, who was, as I told you, a physician. After operation, however, she was most delighted and expressed her gratitude in the most exaggerated way. Wound healing went on to primary union and the case is now being handled with the *x*-ray. The patient's hemoglobin percentage has gone up rapidly and she is physically, and especially mentally, very much benefited by the operation.

CLINIC OF DRS. A. D. BEVAN AND J. C. GILL

Presbyterian Hospital

OSSIFYING ENCHONDROMA OF THE BRAIN

Summary: Jacksonian epilepsy as an indication for exploration of skull; diagnosis—probable type and location of tumor; operative method of locating the fissure of Rolando—technic of removal of tumor from brain tissue.

Dr. Bevan: The first patient I shall operate on this morning is a brain case which has been referred to me by Dr. J. C. Gill.

The man is about twenty-eight years of age and has had for some time attacks of epilepsy of the Jacksonian type, beginning with a convulsion in his left leg. There is no definite history of a trauma to the skull, but as the attacks are so typically Jacksonian in character and as the patient is getting worse, Dr. Gill has insisted, and I think very properly so, that we should give the patient the benefit of an exploration to determine whether there is some gross pathology that can be relieved by operation. I shall ask Dr. Gill to present fully to you the diagnostic side of the case.

Dr. J. C. Gill: This patient when first coming under observation presented symptoms indicative of the grand mal type of epilepsy. Attacks occurring at irregular intervals, characterized by sudden loss of consciousness, accompanied by tonic and clonic spasm of the muscles, followed by a postepileptic sleep. An inquiry into the history of the case revealed an interesting condition. A family history negative, a personal history negative up to the time he was eighteen years of age. About this time he began to have a cramping in the muscles of the left leg below the knee. This spasm of the muscles would last for a few seconds followed by a sensation of heaviness in the involved muscles. These cramp-like disturbances would occur at irregular intervals, varying from one to five or six times a day. As time went on the disturbance extended up the limb, involving the thigh muscles. The spasms became more frequent and severe. About three years after the onset the left arm became involved in the same cramp-like disturbance. Then gradually the muscles of the left side of the face became implicated. Always the onset began in the foot, extending up the leg to the arm and face. At no time did he experience a disturbance in the upper extremity and face without being immediately preceded by involvement of the lower extremity. For about seven years these attacks occurred at irregular intervals unaccompanied by any diminution of motor power or any demonstrable disturbance of consciousness. Three years ago, without warning, the patient suddenly lost consciousness and had an epileptiform seizure of the grand mal type. During the past three years the patient has suffered from both conditions, frequent attacks of spasm of the muscles of the left side of body without disturbed consciousness, and less frequent attacks of the grand mal type.

Clearly, then, we had presented an epilepsy of the grand mal type of three years' duration engrafted upon a Jacksonian epilepsy of ten years' duration.

Physical examination showed a man well developed muscularly, with some slight decrease in strength of the left arm and leg; reflexes of extremities normal except a slight increase of left knee-jerk as compared with right. No Babinski, no ankle-clonus, sensations normal.

Examination of the eyes showed irregularity of pupils, the right being larger and not responding to light as promptly as the left. Ophthalmoscopic examination showed left eye-ground normal. Right eye showed slight choking of disk with secondary optic atrophy. At no time had the patient suffered from severe headaches and there was no history of nausea or vomiting. Mentally he was rather dull and apathetic.

Spinal puncture revealed a fluid under pressure which upon examination showed normal, except a slightly positive Nonne. An *x*-ray picture of the skull showed an indefinite something posterior to the Rolandic area on the right side.

The diagnosis of a probable intracranial neoplasm circumscribed in character located posterior to the leg center in the right Rolandic area was made, based upon the history of Jacksonian epilepsy as described above, the absence of motor paralysis, evidence of choking of right disk with the *x*-ray findings.

Dr. Bevan: The patient is now etherized and we shall proceed to the operation. Dr. Gill has presented to you very clearly the fact that whatever the lesion is it is producing irritation but not destruction, with involvement of the leg center in the right side of the brain. There is also a piece of evidence furnished by the *x*-ray of a peculiar shadow situated quite well back from the motor area, which may or may not mean some definite pathology. I shall plan my operation so as to expose fully the leg center and so that we can extend the exploratory so as to expose the area of the brain in which this shadow is located. I want first to call your attention to the method that we shall employ in locating the fissure of Rolando.

I take a piece of strong silk suture material and measure with this the distance between the glabella and the inion, that is, the distance between the prominent portion of the frontal bone between the eyebrows and the external occipital protuberance (Fig. 401, *a*). I take one-half of this distance from the glabella and then mark out a point in the midline ½ inch posterior to this midpoint. I then drop the line from this point at an angle of 67 degrees from the midline; I mark off this line on the skull with a scalpel by drawing the knife very superficially over the scalp tissue. This gives you the fissure of Rolando. The area around the upper third of this fissure is the leg center. The area around the middle third is the arm center, and the area around the lower third is the center for the face (Fig. 401, *b*, *c*).

Taking this line marking the fissure of Rolando as the center, I mark out a large Omega-shaped flap about 4 inches in diameter, and I shall proceed to raise an osteoplastic flap. The method that we employ in this clinic is the rather simple one of using a small trephine, making five openings with the trephine, and sawing the bone between with a Gigli saw. Some of you who have seen me do these exploratories of the brain know that

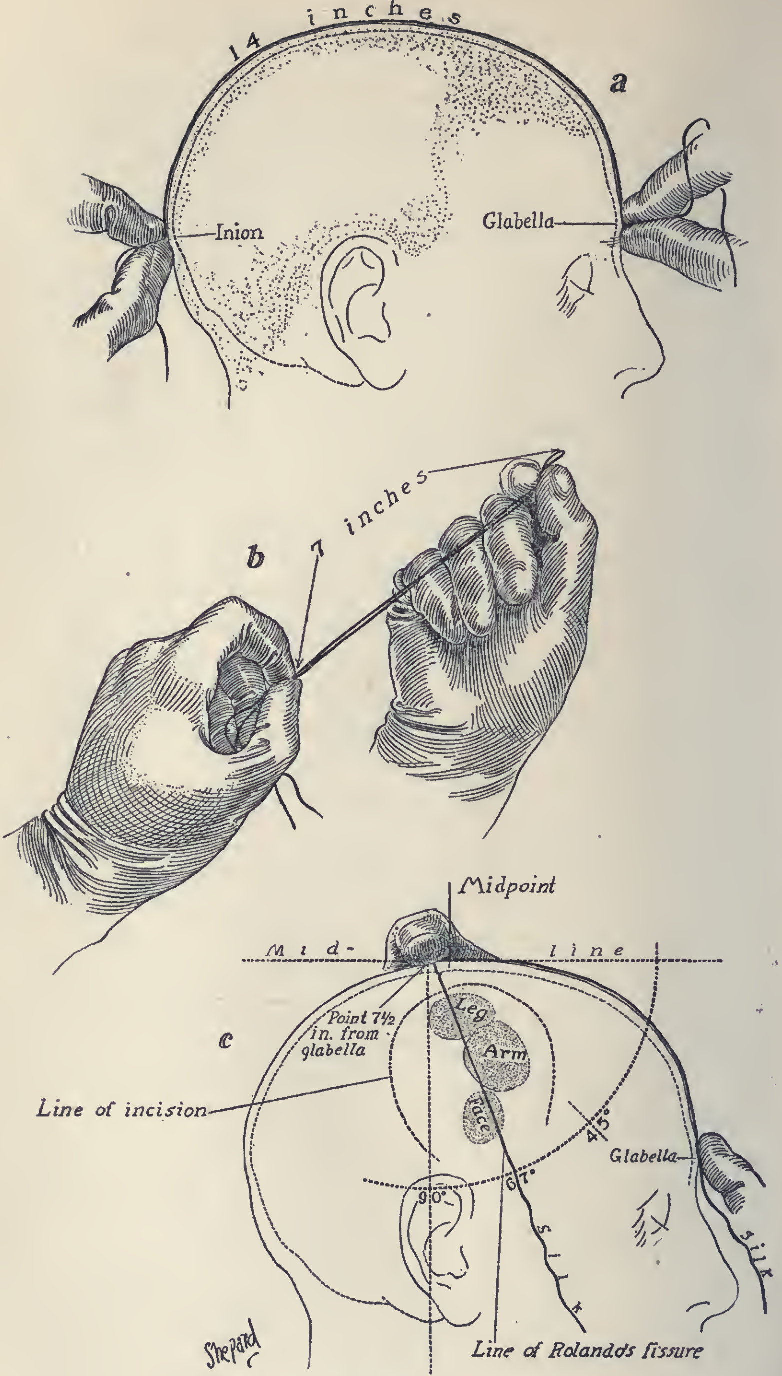
14 inches
a
Inion
Glabella
b
7 inches
Midpoint
Mid-line
c
Point 7½ in. from glabella
Leg
Arm
Face
Line of incision
45°
Glabella
67°
90°
silk
silk
Shepard
Line of Rolando's fissure

Fig. 401.

they are rather time consuming. We control the hemorrhage from the scalp with a large number of artery forceps, and when I use the trephine and the Gigli saw, you will notice that I have my assistant keep the area wet with normal salt solution, because it is very much easier to use both trephine and saw if this is done (Fig. 402, *a*). The sawing is now complete, and with two strong periosteotomes and a Kocher director I elevate the bone-flap, break it back, wrap it up in gauze sponges wrung out of warm salt solution, and put on a large volsellum forceps so as to clamp the bone and the scalp tissue together to prevent any separation during the further manipulations in the operation. You will notice that I have to control some bleeding from a bone sinus in the diploë with some Horsley wax, and I control some bleeding from some venous sinuses at the upper part of the incision close to the superior longitudinal sinus with dry sterile cotton. I now expose the dura. The middle meningeal artery has not been torn and there is very little bleeding. I turn down a curved flap from the dura and add to this two little incisions as as to make practically four dural flaps. I expose the cortex of the brain. In the center of the flap you will notice, marked out by these great veins, the fissure of Rolando. I cannot see any evidence of a tumor or of any gross lesion in the cortex. Very gently palpating it with my index-finger I cannot find any difference in consistency. Introducing my little finger very gently in the direction of the area in which the shadow is shown in the *x*-ray, I come at once to a definite, hard tumor, about ½ inch posterior to my bone-flap. With a pair of rongeur forceps I bite out an area about ¾ inch in width and about 1½ inches from above downward (Fig. 402, *b*, *c*), and expose to view a definite tumor. I can now feel very plainly a tumor that feels about the size of the end of my thumb, that is, let us say, ⅔ inch in diameter. The tumor feels very hard and bone-like. With a small pledget of cotton wet in normal salt solution

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Fig. 401.—Method of locating fissure of Rolando: A line dropped at an angle of 67 degrees from a point ½ inch back of the midpoint between glabella and inion in the line of the longitudinal sinus indicates the location and direction of the fissure.

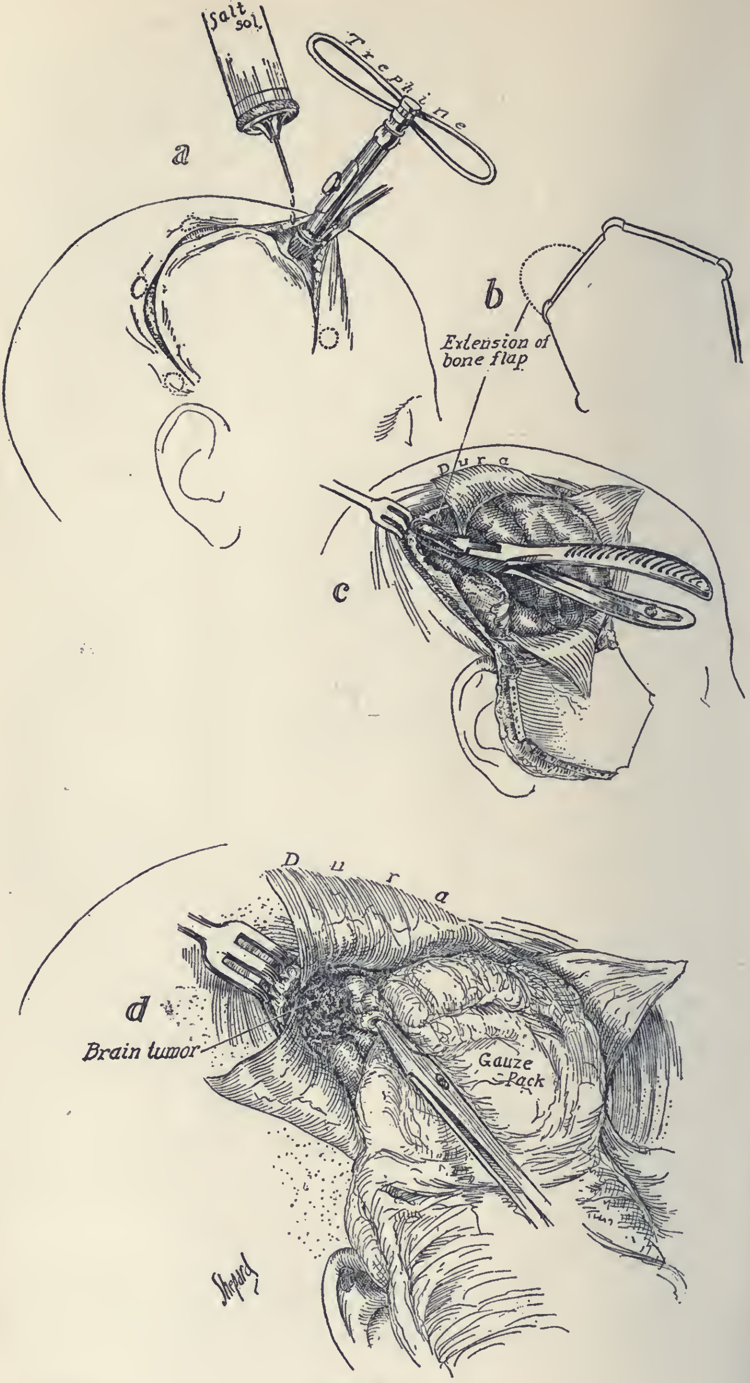
Salt sol.
Trephine
a
b
Extension of bone flap
Dura
c
Dura
d
Brain tumor
Gauze Pack
Shepard

Fig. 402.

and grasped in a small pair of artery forceps I push aside, from the surface of the hard tumor, a thin layer of soft tissue, about $\frac{1}{6}$ inch in thickness, that seems like softened brain cortex (Fig. 402, *d*). I do this very carefully, and yet I injure a good-sized vessel in the pia mater which is grasped by a pair of artery forceps. I ligate it with very fine catgut, which controls the hemorrhage. As I push off this softened brain tissue I uncover a definite hard mass that seems like either bone or cartilage, somewhat irregular in shape. I grasp this with a pair of dissecting forceps with teeth, and then with the greatest possible care, so as to do the least damage to the cortex, I push off the brain cortex from this hard tumor mass with a small pledget of cotton wet in normal salt solution and held in a small pair of forceps. You will notice, too, that I ask my assistant to take a Kocher director, handling it very gently as a retractor, to hold aside the cortex at the point at which I am working with the pledget of cotton. We cannot be too careful in removing a tumor of this kind. You will notice that this little operation is rather time consuming, but the greatest possible care is necessary in the technic of the procedure. Gradually, you will notice, I am pushing aside the cortex for a distance, at some points, of $\frac{3}{4}$ inch at the surface, and gradually freeing this tumor, and fortunately without producing hemorrhage. The tumor is now perfectly free and I can lift it from its bed. It looks and feels like a mass of cartilage, within which there are some very hard areas that feel like bone. I am inclined to believe that it is an ossifying enchrondroma.

The field is now perfectly dry and I shall proceed to close the dura without any drainage and place the scalp flap back in its normal position. The closure of the dura is made with very fine catgut sutures, and as there is no increased intracranial tension, it is possible to do this quite accurately. The osteoplastic flap is now put back in position and closed with five silkworm-gut sutures and with a large number of fine black silk sutures, and the head carefully dressed with a dry aseptic dress-

Fig. 402.—*a*, Drilling holes in skull with trephine. Note stream of salt solution playing over trephine. *b*, *c*, and *d*, Exposure of tumor completed preparatory to its removal.

ing with a soft gauze roller over this and over the roller a starch bandage to hold it firmly in position.

When you realize that only about 5 per cent. of brain tumors are so located and of such pathology that they can be accurately diagnosed and then removed at operation with recovery of the patient, I think you realize that you have been fortunate this morning in seeing this particularly interesting case. I believe that the prognosis is excellent for an operative recovery and that there is a very good prospect of the man's being permanently relieved of his epilepsy. I want to compliment Dr. Gill on his diagnosis in this case and particularly upon his judgment in insisting upon an exploratory. Personally, I was not very enthusiastic about undertaking this work, as I felt that the chances would be that I would simply find that the case was one of epilepsy of the Jacksonian type, but without any gross pathologic lesion that we could find and remove. Fortunately, it has proved otherwise. A case of this kind is a strong argument in favor of exploratories in similar cases. I told Dr. Gill before operation that I thought the chances were 8 or 10 to 1 that we would find nothing that we could remove, and his reply was that he realized that, but that the man's life was becoming a burden to him and to those about him, and that even though the chances of relieving him by operation were small, he felt strongly that the patient should be given whatever benefit existed.

After-history.—The patient went on to a very satisfactory operative recovery. There was no evidence of paralysis following operation. His temperature remained almost normal throughout. He complained of some headaches, and these were relieved by bromids, about 20 grains three times a day. After the first few days there was a very marked swelling of the right eyelid, which, however, rapidly disappeared. I have had the same experience in a large number of these exploratories of having a rather marked edema of the eyelid on the operated side. Microscopic section showed that the tumor was an ossifying enchondroma.

CLINIC OF DR. KELLOGG SPEED

Cook County Hospital

DUODENAL ULCER: PROBLEMS IN SURGICAL MANAGEMENT

Summary: Three patients illustrating certain of the common complications and sequelæ of duodenal ulcer; gastro-enterostomy in duodenal ulcer—factors influencing the patency and functional value of the stoma; acute perforation—the three clinical stages—indicated surgical procedures; mechanism of vicious cycle following gastro-enterostomy; indications for occlusion of the pylorus—technic.

Our service presents three problems in stomach and duodenal surgery which involve many of the active questions in this unsettled and progressing sphere of our work. The lessons they offer, our deductions from them, and the reasons therefor are worth reciting to you.

The first patient was operated on here about three weeks ago. The following facts in his history gave us a basis for surgical procedure. A widower, forty-seven years old, entered the medical service complaining of pain in the epigastrium and nausea and vomiting. These began four weeks before admission, the pain being first noticed once a day, then coming on in attacks similar to attacks he had suffered four years ago. At that time ulcer of the stomach was diagnosed and an operation, a gastro-enterostomy, was successfully performed in Chicago. His pain now is often cramp-like, radiates to the back and chest, and has no relation to food intake. He has used no medicine, but pressure in the epigastrium affords some relief. The pain does not keep him awake at night. Nausea and vomiting appeared ten days before admission, recurring several times, always at the height of his pain. Vomitus consisted of mucus only, never food or blood. This is the first indication of return of his stomach disturbance since the operation four years ago. His appetite has been poor, but there has been no loss of weight, no alcoholic habit, and a general physical examination is now quite negative except for two incomplete direct inguinal herniæ. The blood-pressure is 118–80 mm. Hg. The urine and blood findings are negative. An analysis of the stomach contents showed, in an Ewald test-breakfast removed after one hour, a total acidity of 67, free acid 30, and no blood. The motor tests two days later showed, after removal of a meal which had been eaten eight hours previously, 100 c.c. of contents withdrawn. There were no organic acids, no bacteria, and no blood present. The material removed did, however, contain coarse food particles.

Three different examinations of the feces showed no blood, either microscopically or chemically.

Knowing that he had once had an ulcer and had undergone gastro-enterostomy we were much interested in the *x*-ray findings. The report came back that both the *x*-ray plate and the fluoroscope showed the food passing out through the pylorus and a definite duodenal defect with no apparent sign of a patulous gastro-enterostomy opening (Fig. 403). With these findings it at once became evident to the medical service that the gastro-enterostomy had closed or ceased to functionate, and that his duodenal ulcer had recurred following irritation from the outflow of food through the pylorus and along normal paths, and he was sent to our surgical service for a new gastro-enterostomy.

I studied the *x*-ray plate and was unable to find any evidence of a patulous stoma between stomach and jejunum as represented by the shadows cast by the barium. However, I was entirely unconvinced that the gastro-enterostomy had closed and so committed myself. If you have ever had to undo a posterior gastro-enterostomy connection and form a new one, you have some idea of the peculiar difficulties involved in that surgical procedure. However, his abdomen was opened and the notes of the pathology made at that time were as follows: "Both fibrous and fibrinous adhesions exist between the pyloric end of the stomach and the liver, abdominal wall, and gall-bladder. When these were separated after ligating the most prominent, an indurated ulcer the size of a nickel was found on the anterior duodenal surface, about 1 inch beyond the pyloric vein. This established at once the fact of the existence of the cause of his pain and confirmed the diagnosis of duodenal ulcer. A search was then made for the gastro-enterostomy opening, and after lifting up the omentum and transverse colon we came upon evidence of the former operation. The anastomosis appeared to be in perfect external condition. The bowel and stomach were well united and there were no surrounding adhesions to other viscera. I then made two tests which we always use after a gastro-enterostomy is completed to decide whether or not the

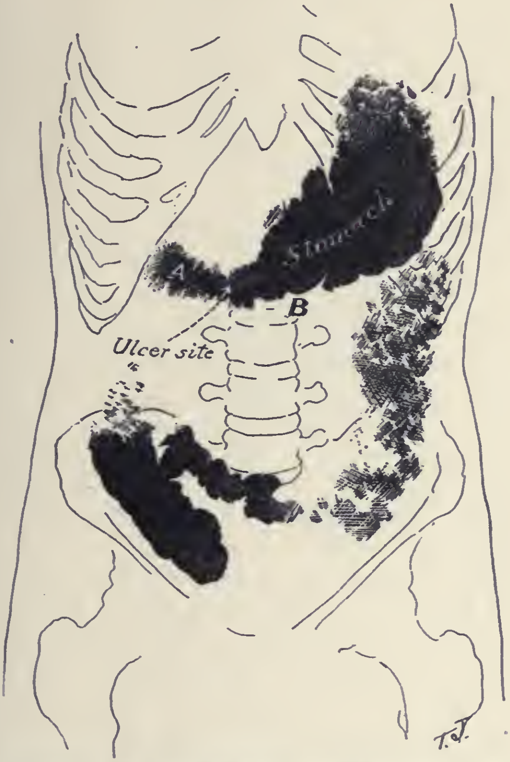

Fig. 403.—Sketch of roentgenogram demonstrating that the pylorus was patent (*A*) and that the gastro-enterostomy opening was not functionating (*B*).

stoma is patent. These are, first, compression of the stomach to force any gas it may contain out through the stoma into the jejunum, first occluding the pyloric end of the stomach so that the gas will not pass out in that direction. I was delighted to find, as I had fully expected, that the gas passed through the stoma made by the former operation.

The second test was then attempted, consisting of invaginating the jejunal wall up toward and into the stomach lumen through the stoma by the pressure of the index-finger. This also appeared to be satisfactory to me, and I made a positive assertion that the gastro-enterostomy was still open and needed no further attention.

There was no evidence of peptic ulcer about the stoma which Eiselsberg[1] found in so many of his patients on whom pyloric closure had been performed. Nor in the face of the well-defined indurated and active ulcer we found in the duodenum could we believe that there was a portion of the unabsorbed suture of the previous gastro-enterostomy dangling into the stomach to cause ulcer symptoms. Woolsey[2] reported such a condition existing twenty-one months after gastro-enterostomy had been performed. So far we have not yet given up the non-absorbable suture.

Returning to the ulcer, we found a few small, hard glands beneath the stomach 2 or 3 inches below the point at which the aorta pierces the diaphragm. They did not show carcinomatous hardness. Relying on the gastro-enterostomy stoma, the operation was continued by opening the pyloric end of the stomach between two forceps and invaginating and closing the incised ends with two layers of linen stitches. The abdominal wall was closed in the usual manner.

Note.—The patient made an uneventful recovery from the operation and within four days was put on a liquid diet consisting of broths, fruit juices, and water, 1 ounce every hour. He progressively improved. Within a week the skin sutures were removed. After nine days the liquid diet was increased to 4 ounces a dose and consisted largely of milk and cream, with soft-boiled eggs every four hours. He suffered no pain and did not vomit once following the operation.

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[1] Surgery, Gynecology, and Obstetrics, 1914, xix, 557.

[2] Ibid., 1917, xxv, 481.

In his second week of convalescence his condition constantly improved. He began to eat light diet and his symptoms completely disappeared. Before leaving the hospital in the third week a complete *x*-ray examination of the gastro-intestinal tract was made, revealing a patent and functionating gastro-enterostomy opening with no six-hour residue in the stomach. The pyloric closure was complete (Fig. 404).

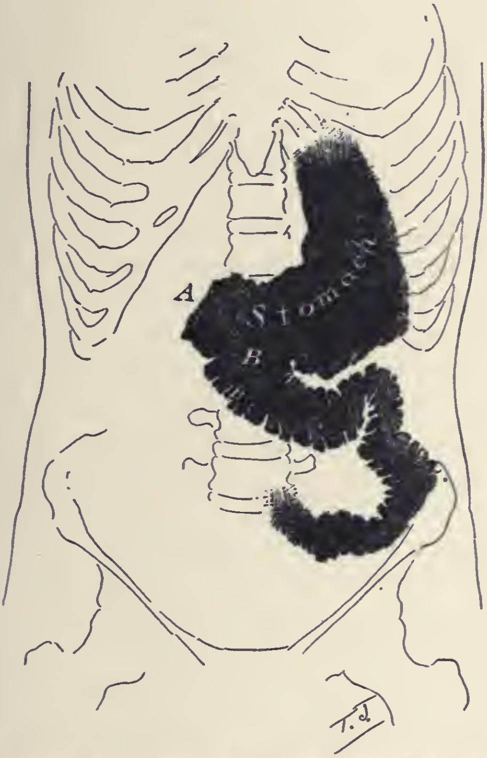

Fig. 404.—Sketch of roentgenogram after operation for pyloric occlusion. The pylorus (*A*) is now closed and the gastro-enterostomy opening (*B*), previously not serving as an exit for stomach contents, functionates in its stead.

The second patient was admitted on the 29th of May at

1.15 P. M. He is a man forty years old with complaints of abdominal pain and vomiting. Inquiry into his history developed that he began to have epigastric pain accompanied by a heavy dragging sensation which appeared two hours after food taking, four years ago. That was relieved in many attacks by vomiting and by the ingestion of soda. He discovered that these attacks were more frequent if he ate coarse foods, and he would often awaken in the night with cramp-like seizures in the stomach region. On two occasions he vomited considerable blood, and in these four years since the onset of his trouble he has been in this and other hospitals undergoing treatment which has always been medical. Two days before admission the pain in his epigastrium became much worse and was practically continuous. Vomiting, which has occurred more frequently recently, has caused the rejection of everything he has eaten in the last two days. He has suffered no loss of weight, but has a poor appetite and has not been able to sleep lately on account of pain.

A general careful physical examination reveals very few interesting facts except that he had an appendectomy two years ago. On admission, he appeared to be well nourished. Blood-pressure was, systolic 120, diastolic 80, pulse pressure 40. There was no time offered to give the customary laboratory examinations because early in the afternoon of his admission he developed violent pain in the epigastrium, accompanied by vomiting, and his abdomen began to distend and became very tender. He was at once transferred to our service for surgical attention with a diagnosis of ruptured gastric ulcer, and within six hours after admission to the hospital was put upon the operating table. He vomited just before taking the anesthetic and because of tender distention and tympany it was impossible to obtain any abdominal findings by palpation. No *x*-ray examination had been possible.

The abdomen was opened and the following pathology was discovered: When the peritoneum was picked up and incised there followed an immediate escape of gas from the general abdominal cavity. We had taken the precaution to administer to this man about forty minutes before operation 3 ounces of methylene-blue solution which it has become our custom to use in cases of suspected gastric or duodenal ulcer. This method was suggested some three years ago by Dr. Baker, who was intern on our service at the time, and who made a report of the procedure. We find that the blue stain leaking out of a perforating ulcerous point enables the operator to identify it at once and frequently obviates handling of viscera and disturbing walled-off areas. After the abdomen was opened there was found a moderate amount of opaque creamy fluid in the right upper quadrant. The omentum was turned up and lay over the stomach and at each inspirational movement of the diaphragm there was a distinct hissing noise caused by gas issuing from the ulcer, which was clearly seen on the anterior surface of the duodenum a few centimeters from the pyloric vein. Here also was found a blue stain escaping from an ulcerated perforation about 2 mm. in diameter. The liver border was attached to the anterior stomach wall by fibrous adhesions. These adhesions and others between the colon and omentum were broken down. The free fluid in the abdomen was wiped away with dry pads and the perforation was closed by two layers of linen purse-string sutures.

The peritoneum and fascia were closed by interrupted catgut suture and a cigarette drain was inserted down to the ulcer site. Skin closure followed with silkworm-gut. The patient's condition at the time the operation ceased was not very good, and it was considered impossible to undertake a gastro-enterostomy or any other surgical step at the time. Of this I shall speak later.

He made a fairly rapid recovery. The cigarette drain was removed within forty-eight hours and the wound gradually closed without suppuration. As with the first patient, he was gradually put upon liquid diet, starting with 1 ounce mixture of milk and cream and weak broths every two hours, until in the third week we were able to give him a light diet. He is now in the fourth week, has been on light diet for some time, and at this date has suffered some return of pain and distress following his noon-day meal. He says he has had no pain up to this time and has not been kept awake at night. The abdominal wound has healed and his general condition has much improved, and soon we will be face to face with the problem of further surgery for curative purposes, or a discharge from the hospital to await return of more serious symptoms.

Note.—Six weeks after operation the patient has had no return of discomfort or pain for ten days. He is gaining weight and strength and is preparing to go home with instructions covering food he may eat, advice to take six meals a day, and alkaline powders for continued use for three months.

Our third patient is a machinist, twenty-eight years old, married. He has been transferred to us from the medical service complaining of hemorrhage from the bowels and a dragging sensation in the abdomen. Most of his trouble dates back two years, when his appetite diminished and a dull dragging feeling —not actual pain—started in the upper abdomen. This occurred daily for months at a time with remissions of varying periods. Quite constantly he suffered from abdominal distress about 3 or 4 o'clock in the afternoon and again about midnight, but he has never vomited and he found that taking food relieved his distress. The quality and quantity of the food does not seem to alter his condition, which has remained more or less stationary these two years. At times he has used without advantage ½ teaspoonful of soda and also dilute hydrochloric acid in 6-drop doses.

On April 23, 1919, he had a sudden profuse hemorrhage from the bowel. The blood was bright red in color; the hemorrhage was not preceded by pain. During the following day and a half he had three more bloody stools and he was then taken to a hospital. The attending physician assumed he had a severe anemia.

Since these hemorrhagic attacks his appetite has improved and he feels all right. There has been no vomiting or abdominal distress. Once each day he has been taking ½ teaspoonful of soda.

The general survey of his history is negative except that he suffered a kinking of the intestines ten years ago and had a tonsillectomy at eight years of age. He is married and has one well child. The left tonsil is large and cryptic. His abdomen presents no abnormal palpable masses or tumors. Other physical examination is negative. Blood-pressure: 120 systolic, 68 diastolic, pulse pressure 52.

He was admitted with a diagnosis of duodenal ulcer. Three days later it was noted that he had epigastric pain three hours after eating, but no vomiting and no more bowel hemorrhage. A moderate secondary anemia was present, red cells, 3,300,000; white cells, 7400; hemoglobin, 65 per cent.; color index, 1. Hyperacidity was present and an Ewald test-breakfast given at 8.30 A. M. June 19, 1919, and withdrawn one hour later showed 200 c.c. of material, free acid 56, total acidity 87, no organic acid, and no blood chemically or microscopically. Examination of the feces on four successive days showed no mucus, pus, blood, ova, or parasites.

He was sent to *x*-ray department, with the following result: No six-hour residue was present. The gastric shadow was complete except for a small notch-like defect bordering on the pyloric ring. The duodenal shadow was deformed throughout the examination and the findings indicated an intrapyloric ulcer with involvement of the duodenum.

His severe hemorrhage and the necessity for returning him to work bring him to the operating table after these two years of pain and distress. I will open the abdomen through a right rectus incision. I find the great omentum, and when I attempt to lift it up I notice that it is attached at one point near the right anterior superior iliac spine to the anterior abdominal peritoneum.

After ligating and cutting the omental adhesion to the abdominal wall, and turning up the greater omentum, I lift the transverse colon to expose its mesentery. Through a narrow slit in the mesentery, avoiding visible blood-vessels, I can pick up the posterior wall of the stomach and bring it out. A point is selected fairly well down toward the greater curvature and as near the pyloric end as can be comfortably drawn through. The stomach is then clamped with a straight rubber-padded clamp, and the jejunal fossa is next explored until the ligament of Treitz is exposed, and the jejunum is picked up at its beginning. The gut loop is followed a few inches and then turned back toward the patient's right side so that an area for attachment on its free border can be selected which will give the direction of the stream of gut contents in the same direction as that of the stomach contents.

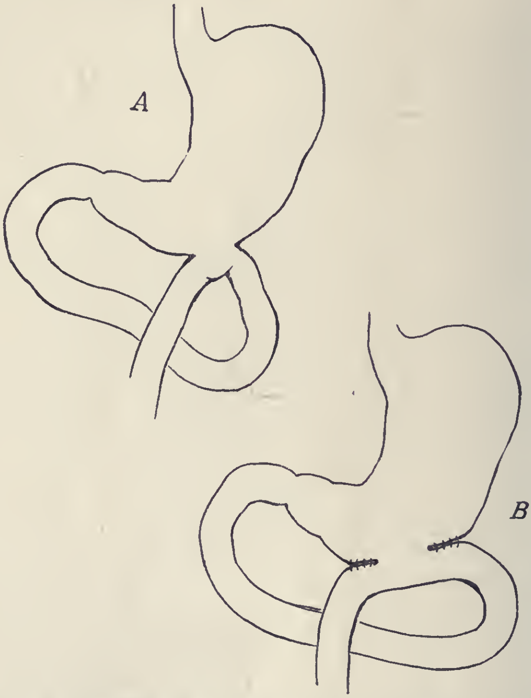

Fig. 405.—*A*, Diagram showing tendency of bowel to kink in simple gastro-enterostomy attachment. *B*, Attachment of bowel to stomach beyond the stoma border in order to avoid kinking.

This is called an isoperistaltic attachment and does not favor the formation of a vicious circle. I do not believe there is any danger of kink in the afferent loop because we attach it to the stomach at some distance from the edge of the gastro-enterostomy suture by small tacking stitches (Fig. 405, *B*). Also we employ the method of suturing the newly attached gut and bowel to the torn edge of the mesocolon. Then the posterior stomach wall cannot herniate out into the general peritoneal cavity nor can the bowel herniate up into the lesser peritoneal cavity.

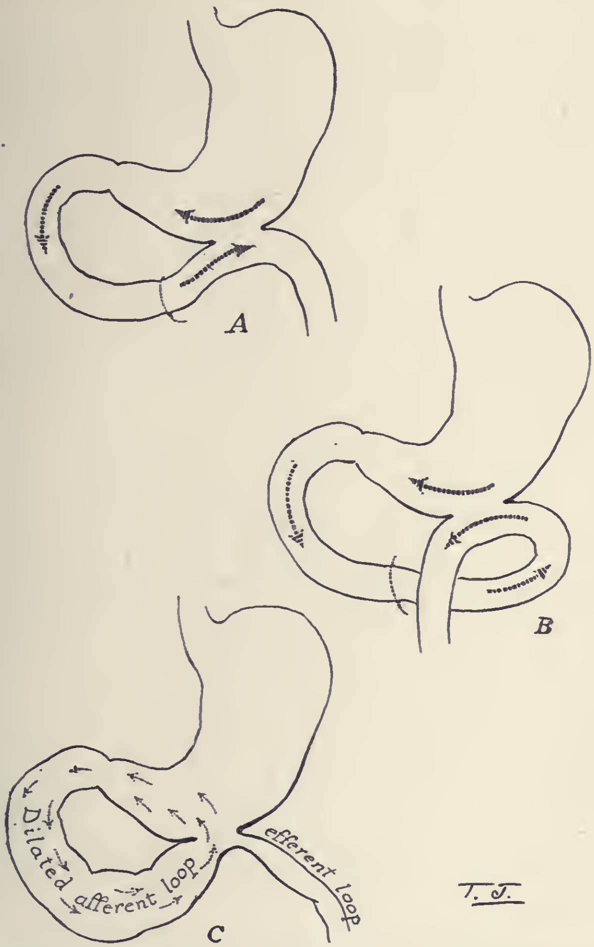

Fig. 406.—*A*, Antiperistaltic attachment of jejunum to stomach. Arrows indicate food currents. *B*, Isoperistaltic attachment of jejunum to stomach. Arrows indicate food currents. *C*, Diagrammatic illustration of dilated afferent loop in antiperistaltic attachment. Dilated loop crowding out efferent loop and tending to form vicious circle as designated by arrows.

The efferent loop passes down into the abdomen with little danger of a kink. If the attachment of the jejunum is made in the opposite direction, that is, in an antiperistaltic direction, without swinging the loop back, we might expect that bowel peristalsis would tend to drive back food attempting to pass from the stomach into the bowel (Fig. 406). If the stomach is atonic when this antiperistaltic attachment is employed and no pyloric closure is made, we can believe that the efferent loop of jejunum is not forcibly offered food by the stomach. The duodenal and jejunal afferent loop between the pylorus and gastro-enterostomy opening becomes enlarged, loaded with food contents, and tends to crowd out the opening of the efferent loop. This food is returned to the stomach by the gastro-enterostomy stoma after it has once left through the pylorus. Therefore to avoid chance of this occurrence we prefer the isoperistaltic attachment. I shall use a three-layer suture with linen for the gastro-enterostomy.

Now that the connection is made and sutured to the opening in the mesocolon I perform the two tests referred to, to show the patency of the stoma. I am satisfied that a generous opening exists. We believe that it makes little, if any, practical difference whether the stomach opening is oblique or parallel with the greater curvature, but it must be in a dependent portion of the stomach near the greater curvature and pylorus. Vicious circle is rarely seen after this technic. Sometimes there is acute dilatation of the stomach following this operation which may simulate vicious circle. Such dilatation can be noticed by the operator before he closes the abdomen after the clamps are removed from the stomach. Disagreeable hemorrhage also rarely follows from punctured stomach vessels, but a Lembert stitch controls the bleeding.

For rapid gastro-enterostomy one may use the special Murphy button. With that the technic is simple and rapid. If the button had been used in Case I, I might have been willing to believe that the gastro-enterostomy had spontaneously closed, because of the few spontaneous closures or stenoses of gastro-enterostomy stomata, at least two have followed button operations.[1]

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[1] Lewisohn, Surgery, Gynecology, and Obstetrics, 1917, lvx, 505.

This closure we can attribute to imperfect approximation of the mucous surface which pulls apart after the button drops away.

The resulting infection and scar formation in the other bowel layers leads to contraction and stenosis or obliteration of the opening. In sutured gastro-enterostomy spontaneous obliteration is very rarely seen. Tuffier[1] reported one instance in 1907 which he reoperated nine years after the first gastro-enterostomy to find no evidence of the stoma.

Consequently, no matter what type of operation you do you may later find that the stoma has closed; if, however, we can do also a pyloric closure, it would seem that the danger of the gastro-enterostomy ever being shut off would be minimized by the constant forceful offer of food from the stomach. My work on this patient has not finished because I am going to do a pyloric exclusion or closure. The knowledge gained from Case I, whose ulcer recurred after four years in the presence of a gastro-enterostomy, inclines us more toward combining pyloric closure with gastro-enterostomy in healthy adults.

Moreover, after these young people leave the hospital they easily get into careless eating habits and may suffer ulcer recurrence. Also we feel that a gastro-enterostomy does not truly drain any stomach the pyloric path from which is patent. As long as there is pyloric spasm from an open ulcer subjected to acid or the irritation of passing food, or if there is a pyloric obstruction of any character, then the gastro-enterostomy will drain the stomach. Patients with pyloric and duodenal ulcers nearly always do well for some time after gastro-enterostomy alone. The new stoma does drain the stomach to some extent, but there is little material in the stomach to drain at first, because the patients are not fed much. When diet is begun it is one which is non-irritating and which tends to absorb as much acid as is present, and it is frequently accompanied by the administration of alkaline powders of magnesia and soda. The food, in small quantities and of non-irritating quality, is offered every hour, hence there is little opportunity for acid to accumulate in the stomach. The ulcer, consequently, is not much disturbed. Stomach acidity is also probably reduced by the entrance into the gastric contents of fluid from the jejunum by way of the stoma. These contents contain both bile and pancreatic juice, which are alkaline. After a gastro-enterostomy the ulcer then has rest, minimum quantity of alkaline or non-irritating food current, and a greatly diminished amount of traffic passing over it. It naturally improves if it can, and medical men, knowing that they can obtain like results by feeding and alkalinization, have in part opposed operation of any kind. I say little here about ulcer excision by means of cautery or knife because I have not used that method on these patients.

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[1] Bull. et Mem. Soc. de Chir. de Par., 1907, xxxiii, 463.

With the benefit of postoperative care most patients leave the hospital free from pain and much improved. They should be cautioned to follow ulcer diet for three to six months. That includes alkaline powders and six meals a day. Some ulcers will return after gastro-enterostomy. Those with broad indurated bases attached to the pancreas, liver, gall-bladder, or other viscus which are not free and have little chance to completely cicatrize must, of necessity, heal slowly. Long before they are obliterated the patient, finding relief from pain, becomes careless of his diet, and a new irritation of the ulcer site starts or a new site develops. We do not know for certain that the ulcer found at the second operation in Case I was the primary ulcer. We know that we found but one indurated ulcer area, the peritoneal surface on the duodenum showing old white puckered scars. Ulcers on these bases which refuse to cicatrize are difficult to heal, and may be very difficult to excise. Another type liable to have ulcer recurrence are those patients on whom no pyloric closure is performed at the time of gastro-enterostomy. After healing, the old habits of eating return, the food naturally passes via the pylorus over the old ulcer site, and the gastro-enterostomy stoma ceases to functionate, as in Case I.

We must now finish the pyloric exclusion in this healthy young man. Animal experiment has shown that there is but one true pyloric closure, that of Eiselsberg, which consists in pyloric or prepyloric division of the stomach with closure of both ends, suturing each layer after infolding the mucosa. This I shall perform here, cutting the stomach either with a cautery knife or a long-bladed scissors, after passing clamps across the pyloric region. The closure is made. This operation alone is formidable enough and many operators condemn it on that ground. Stomach surgery has passed through four stages of pyloric exclusion, and the only one which has stood the test of time is the one done here—complete pyloric division and suture of both openings.

The infolding method (Kelling-Mayo) was an attempt to narrow the antrum pylori by three or four infolding stitches so that food could not pass by. Pyloric exclusion by means of autoplastic material (Wilms and Strauss) was done by using free transplants of fascia or muscle to make constriction about the pylorus. Strauss freed the muscularis from the pyloric mucosa without opening the stomach and applied a constricting autogenous transplant from the rectus muscle. Pólya used the ligamentum teres hepatis, but nature re-establishes the channel very quickly whether fascia, muscle, silk, linen, catgut, or other material is used. Consequently, the exclusion method with the aid of foreign materials has been given up. We must not neglect to refer this patient for tonsillectomy after his recovery so that this known focus of infection can be removed as a guard against formation of ulcer elsewhere in the gastric area.

These operative explorations afford us a prime opportunity to study living pathology. We are that much in advance of the surgeons of forty years ago who saw only the general peritonitis following perforation, and in the autopsy room, examining the abdomen filled with purulent exudate, failed to note the small duodenal perforation. The ulcer which was the cause was literally drowned in the infected abdominal cavity. Today, when we are all cognizant of these lesions, and see them first fluoroscopically and in the roentgenogram, we have less excuse to offer for a muddled diagnosis. Recalling the history of Case II, whose trouble dated back at least four years, we find that two years ago some surgeon removed his appendix, with no relief, of course. We must study stomach disturbances more intelligently.

Appreciating the difficulties in the path of the surgeon a generation ago, we must accord them the more honor for their pioneer work in stomach surgery. The first gastro-enterostomy dates back to 1881, done by Wölfler, but it was not until 1885 that the present method of choice, posterior retrocolic gastro-enterostomy, was performed by Hacker.

There are certain physiologic and technical points which these three patients illustrate by their operative and post-operative pathology. Taking up first the technic of operation, we find that there must be considered the degree of acuteness of the ulcer. Are we doing an operation of election, a gastro-enterostomy for diagnosed pyloric or duodenal ulcer, or are we dealing with an acute ulcer perforation which requires life-saving action? In an acute perforation, presented by the second patient, several factors must be weighed. In order of their importance they are: (1) Time elapsed between perforation and operation; (2) virulence and rate of leakage; (3) prospects of limitation by adhesions or of spreading peritonitis; (4) general resistance of the patient.

W. J. Mayo has described the three clinical stages of the perforation as: (*a*) Stage of contamination, usually accompanied by shock, localized pain, and tenderness; (*b*) stage of reaction, in which the patient's condition improves and which is of varying duration; (*c*) stage of general peritonitis, often of progressive character, which leads to local abdominal findings of pain and tenderness, which camouflage the true case. The progressive and painful inflammation of the peritoneum tends to spread downward, especially toward the appendix, and the misleading findings often induce the operator to open the abdomen over the right iliac region. An appendix inflamed externally from the spreading peritonitis has frequently been removed as cause of the acute illness, the true cause or perforation being overlooked. Should not every removed appendix be subjected, therefore, to minute pathologic examination?

Returning to the points mentioned as valuable factors in acute perforation, we can say that duodenal and pyloric perforations operated on within eight or ten hours offer a very good prognosis. This prognosis declines in value as longer time elapses before operation. Occasionally ulcer perforations of several days' standing are successfully closed. I mentioned one in the Surgical Clinics of Chicago, Vol. I, August, 1917, p. 717. Success in such an instance would depend on the predominance of some of the other factors we are to discuss.

Acute duodenal perforations are the most common perforations of the abdominal viscera. After ten hours the stage of primary reaction is passed and general septic peritonitis is beginning. After forty-eight hours the patient's general condition may improve and operation may be safely undertaken with less danger from operative depression. Each case is a law unto itself, and the surgeon must decide. While the elapsed time is very important, its value is tempered by the other factors. The quantity and virulence of the leakage must be weighed. Duodenal perforations are usually small and the leakage is slow. We know also that although stomach contents show many living bacteria, duodenal contents are relatively sterile.

The prospects of limitation of the leaking intestinal or stomach contents varies with the anatomic location of the hole. When it is situated on the anterior surface, intestinal contents usually extend into the general peritoneal cavity; when on the posterior surface, toward the lesser peritoneal cavity. The location of the perforation in relation to liver, gall-bladder, colon, and omentum, which may aid in the walling-off process, is also of pathologic importance.

The omentum, which is naturally mobile, frequently acts in these perforations as it does in appendical inflammations; functionating as an abdominal fireman, it tends to hurry to the point of inflammation, the only restriction being preformed adhesions. Case II illustrated this point. The omentum was turned up over the stomach and lay folded on top of the localized pocket of leaked material. Leakage into and toward the lesser peritoneal cavity tends to become well localized; it may contaminate the pancreas. Any adjacent viscera tend to offer barricades against extension of infection. When the perforation is seen early and the abdominal pain and distention are of rapid onset and spread, we presume that the perforation has been on the anterior surface and is not well protected by walling-off viscera and omentum.

The patient's general resistance and condition when first seen are also factors to be considered. If, as in Case II, the shock has been severe and the extension of the abdominal distention is rapid, and if the patient does not do well under anesthesia, it has always seemed wiser to me to close the ulcer and omit attempts at gastro-enterostomy. That operation can wait until there is less risk to the patient, and in the face of a potential serious infection of the general peritoneal cavity we must consider carefully whether to go to the extreme of further operation. There are also other points in connection with drainage of the stomach and the mechanical route food takes after gastro-enterostomy which makes additional discussion of these operations necessary.

The first case illustrates the physiologic tendency of the food current to return to its natural path. The nature of muscular propulsion of stomach contents by the three layers of stomach muscle is such that the food mass is induced to go out by the pylorus if it can. If the pylorus is closed, the increased intragastric pressure will force the food via the artificial stoma of a gastro-enterostomy, and drainage of the contents will be satisfactory. Case I had no vicious circle and food did not pass back into the stomach; it ignored the gastro-enterostomy stoma until it fooled observers into believing that the stoma was closed or disconnected.

In acute perforation, to return just for a moment to the desirability of gastro-enterostomy at the time the hole is closed, even if we do the drainage operation, we would hardly get complete rest for the ulcer site unless we excised it or closed the pylorus. Should we adopt pyloric closure then as a routine, and can we in these cases do so much surgery in the face of shock and potential infection? That depends on the factors I have enumerated, especially on the patient's condition, and also to a degree on the rapidity with which the surgeon works. It is much better, of course, to return a live patient with his perforation closed than a moribund patient with a gastro-enterostomy performed. Careful diet will nearly always bring the patient to an operable condition later. A case just reported in the Journal of the American Medical Association[1] cites the perforation of a duodenal ulcer about one week after gastro-enterostomy was performed. This may verify some of the points I have made concerning gastric drainage and pyloric closure.

The trend of surgical opinion seems to be toward pyloric closure along with gastro-enterostomy, but this point is still under discussion. The first case seems to be a strong argument in favor of closing the pylorus. In the third case we use the closure as a prophylactic because the man is young, he must work, and wishes to have no future trouble. In a statistical analysis of the stomach and duodenal ulcer patients treated at Rochester, Minn., we find that results were traced in 96 per cent. of the total number. Considering only the patients with duodenal ulcers, of whom there were 1651 under observation for an average period of 3.4 years, it was found that 85, or 5 per cent., died. The mortality in gastric ulcer patients is almost three times as great. The causes of death in the patients were not listed. Would it be possible to improve the percentage of permanent cures by using ulcer excision or pyloric closure with the gastro-enterostomy? That is a subject worthy of much thought.

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[1] Carr, Jour. Amer. Med. Assoc., vol. 73, No. 1, p. 34.

CLINIC OF DR. A. J. OCHSNER

AUGUSTANA HOSPITAL

TECHNIC OF PARTIAL GASTRECTOMY

Summary: A patient, seventy-one years of age, in whom a probable diagnosis of localized gastric carcinoma is confirmed on exploratory laparotomy; detailed description of the operation for removal of the tumor.

THE patient, a male, aged seventy-one, was admitted to the hospital April 1, 1919, complaining of pain in the umbilical region.

The present trouble began one and a half years ago as slight pain coming on directly after meals following a severe attack of constipation. Occasionally the pain is very sharp, but ordinarily is more like a heavy load in the stomach. At present the pain is constant, becoming more severe after meals, and lasting for one and a half hours. He has lost 10 pounds in weight since January, 1919.

Appetite poor; sleeps well; bowels regular and urination normal.

Past History.—The patient has suffered periodically from gastric disturbance, increased upon taking acid food, raw fruit, or vegetables or tough meat, and subsiding upon adhering to a bland non-acid simple diet. He has had a valvular cardiac lesion for the past twenty-five years.

Family History.—Negative.

Physical Examination.—Chest negative except for heart lesion.

Abdomen.—An indefinite tumor mass can be felt at a point 1 cm. above the umbilicus in the midline and 1 inch to the right. A maximum degree of pain is elicited on deep palpation. There is slight tenderness over the gall-bladder region on deep palpation. On coughing or straining a tumor mass presents itself in the right inguinal region, which disappears spontaneously into

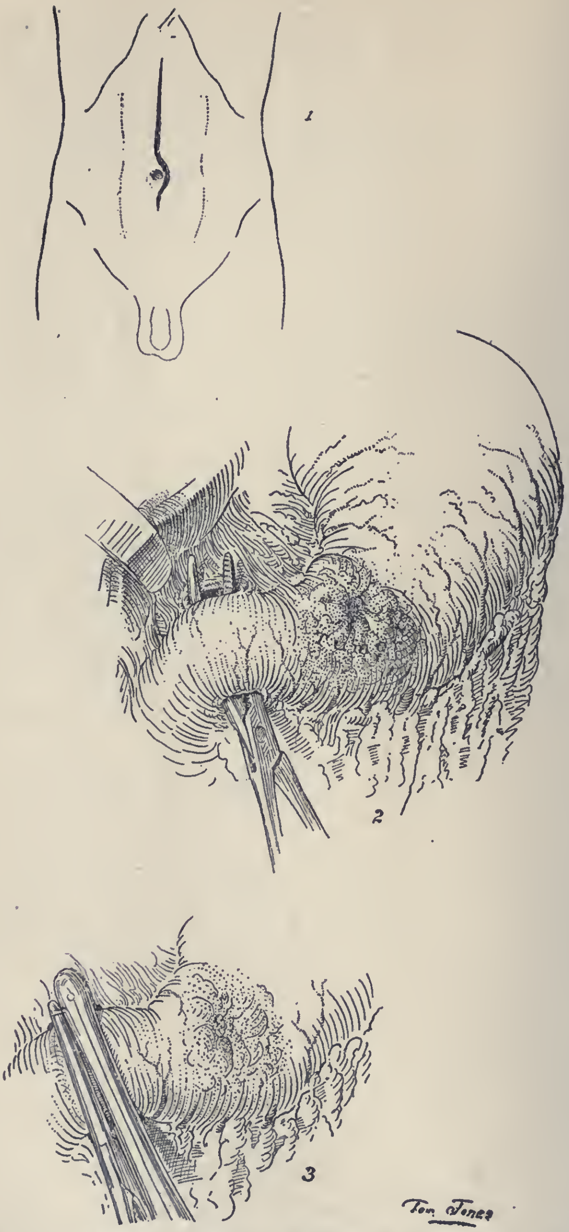

Fig. 407.—1, Midline incision for exposure of stomach. 2, First step in the operation—preparing a site for section of the duodenum. Note location and extent of tumor. 3, Duodenum clamped preparatory to division.

the general peritoneal cavity. The internal ring on the right side admits the tip of the thumb.

Our diagnosis in this case is carcinoma implanted upon the base of an old gastric ulcer. The history is clearly that of gastric ulcer. The present condition dates back one and a half years, and it is possible, but not probable, that the carcinoma has existed during this entire period. The fact that this tumor is movable makes it worth while to make an exploratory operation even in a patient seventy-one years of age.

Operation.—We make an incision, 20 cm. in length, extending from the ensiform cartilage to a point 4 cm. below the umbilicus (Fig. 407, 1). In this way we are able to expose the stomach, duodenum, and gall-bladder, and it will be easy to reach the jejunum in case excision of the tumor is decided upon. This incision immediately exposes a tumor 12 cm. in diameter, representing an old, indurated gastric ulcer with evidence of having perforated, the perforation having been closed by means of omental adhesions. The ulcer itself is 7 cm. in diameter, the induration extending about 2 cm. beyond this in every direction, and apparently the pylorus is almost completely occluded. There is evidently a carcinomatous degeneration of the center of this ulcer, but this seems to be fairly circumscribed (Fig. 407, 2).

The omental adhesions are first clamped, cut, and ligated, leaving the pyloric end of the stomach exposed. The tumor is entirely confined to the gastric side of the pylorus, and consequently it will not be necessary to remove any portion of the duodenum. An opening is made behind the duodenum 1 cm. beyond the pylorus (Fig. 407, 2) by means of blunt-pointed curved forceps. A pair of straight hemostatic clamps of the Kocher pattern, but of large size, are passed through this opening (Fig. 407, 3) and clamped on the duodenal side. Then a heavy crushing clamp is placed on the gastric side and the duodenum crushed at this point. The duodenum is then cut between the two forceps (Fig. 408, 4) and the bleeding points are caught and ligated. The little ribbon of tissue projecting beyond the forceps (Fig. 408, 4, *A*) is then caught in mouse-toothed clamps (Fig. 408, 5). A chromicized catgut ligature is then tied tightly in the groove left by the forceps and the projecting portion is inverted into the lumen of the duodenum (Fig. 408, 6), a silk

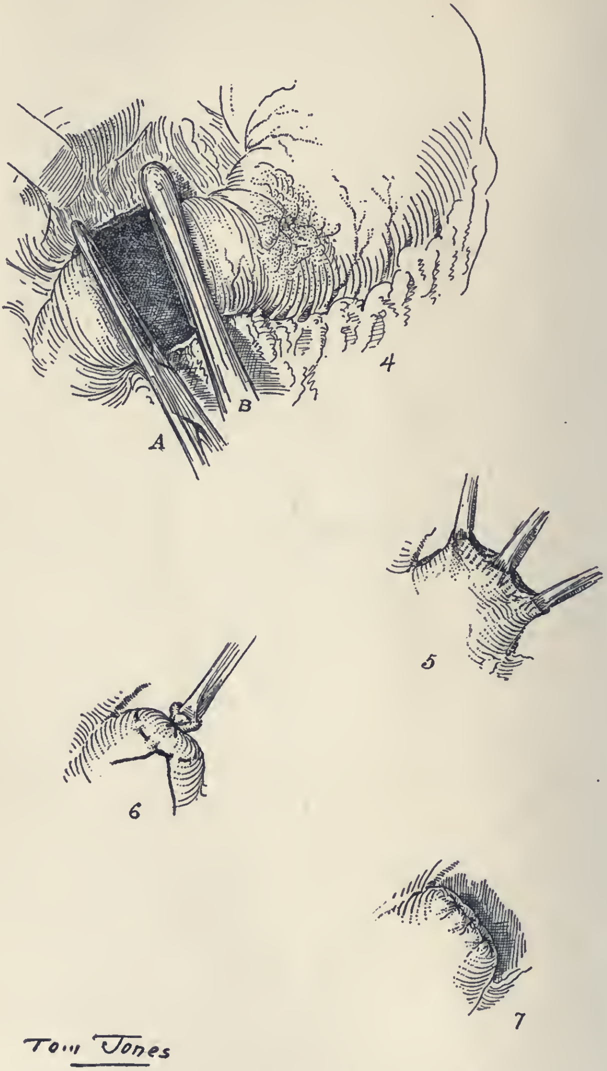

Fig. 408.—Steps in the closure of the duodenal stump.

purse-string suture being placed at a distance of ½ cm. beyond the cut ligature. This is then tied and the projecting mucous membrane is permanently inverted. The closure is then reinforced with a few interrupted silk sutures (Fig. 408, 7). The stump of the duodenum is dropped back into the abdominal cavity and the surface covered with moist gauze pads.

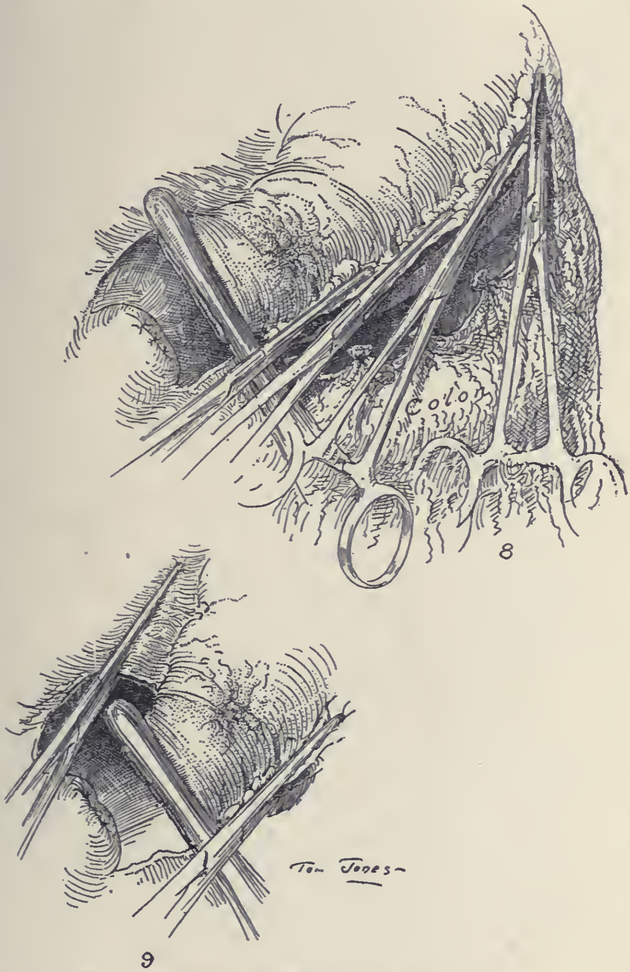

Fig. 409.—Mobilizing the stomach.

The pyloric end of the stomach is now freed from its attachment to the omentum by grasping the omentum between two pairs of large sized Kocher forceps and cutting step by step, ligating on the side of the colon and leaving the forceps on the gastric side in place (Fig. 409, 8). Care must be taken not to destroy the arteries supplying the transverse colon, which can easily be avoided by lifting the omentum successively step by step before applying the clamps. The same process is then carried out on the side of the lesser omentum (Fig. 409, 9). As the coronary artery (see arrow, Fig. 410, 10) is approached, it is important to proceed with special care, because in this region the accompanying veins frequently are so thin walled that they are easily torn, giving rise to very copious hemorrhage. In this region one frequently encounters enlarged lymph-nodes, which should be carefully removed. In many cases we have found that these are entirely free from carcinomatous infection so far as can be demonstrated by microscopic examination, but it is possible that, notwithstanding this, they may contain some infection and, consequently, should be removed.

Having freed the pyloric end of the stomach completely, it is lifted up and two large clamps (*C* and *D*, Fig. 410, 10) are applied. It is doubtful whether it is best to cover the clamp on the proximal portion of the stomach with rubber to prevent too severe crushing or to use the forceps without this protection. When rubber is used the stomach wall sometimes slips, giving rise to a considerable amount of annoyance, unless one is exceptionally careful in selecting forceps of the proper caliber. The distal end of the stomach is cut away by applying the electric cautery between these two pairs of forceps. There seems to be virtue in the use of heat in these operations for relief of cancer, so that accounts for our choice of the cautery for cutting away this portion of the stomach. The mucous membrane projecting between the blades of the forceps (Fig. 410, 11) is then further seared with the electric cautery. In the manipulations which have just been completed it is important not to injure the pancreas which is exposed during these steps of the operation (Fig. 410, 11). An opening is then torn in the transverse mesocolon, unless this has already been opened during the previous step, and a loop of the jejunum, 2 cm. from the point at which it emerges from the root of the mesentery, is

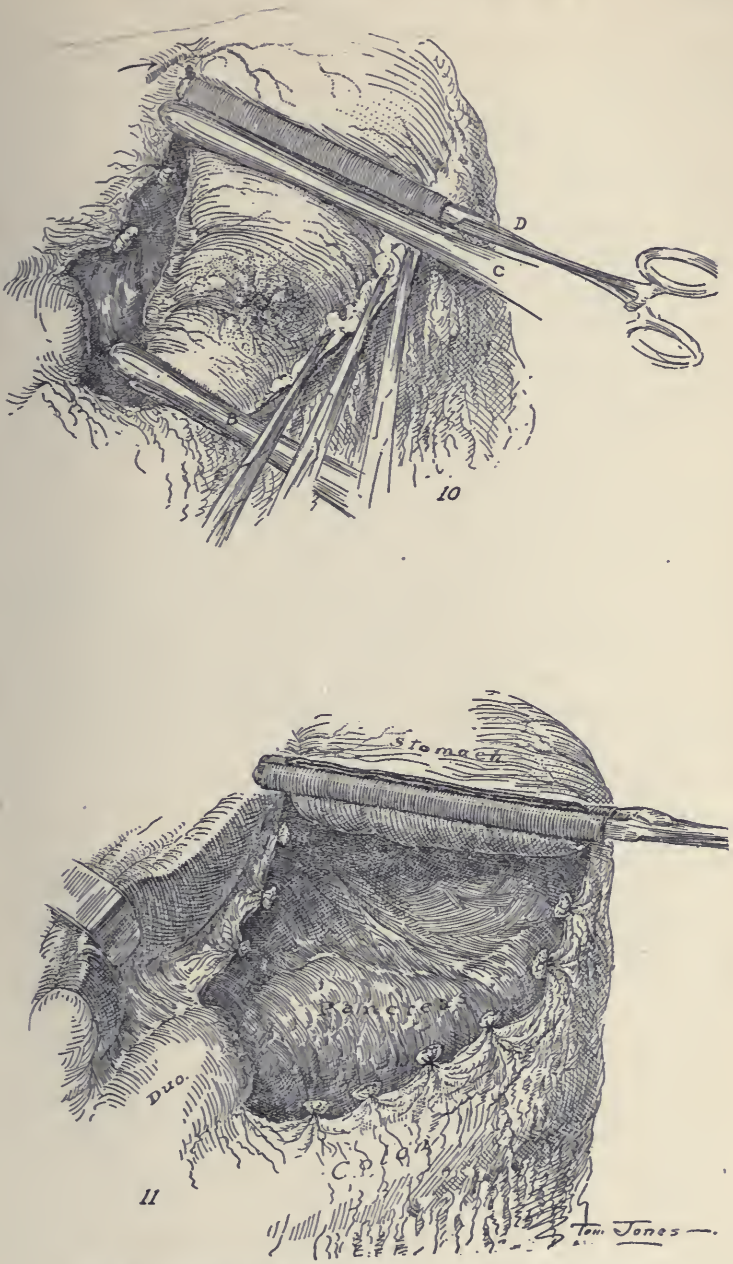

Fig. 410.—Removal of tumor-bearing portion of stomach.

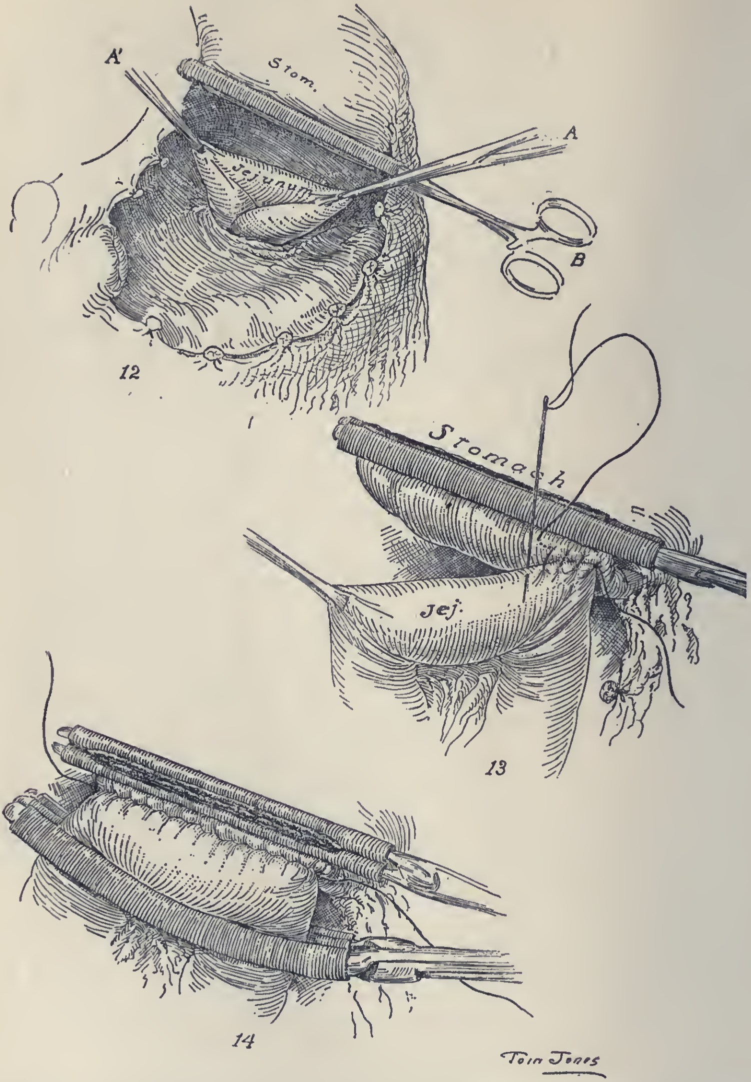

Fig. 411.—Jejunum is brought through a hole in the mesocolon (12) and attached to the stomach by a continuous Lembert suture (13 and 14).

brought through this opening by means of curved forceps (Fig. 411, 12, *A* and *A′*) which are placed on the jejunum at a distance from each other equal to about two-thirds of the length of the mucous membrane of the stomach exposed in the grasp of the forceps (Fig. 411, 12). This loop of jejunum is then sutured with continuous silk or catgut to the posterior surface of the stomach (Fig. 411, 13), care being taken to carry the suture down to the mucous membrane, but not through it, getting a good grasp on the submucous connective tissue. A line of suture is place within 2 mm. of the edge of the stomach grasped by the forceps. When this row of sutures has been completed another pair of forceps replaces the first two applied to the jejunum (Fig. 411, 14) in order to prevent escape of any of its contents during the further steps of the operation. This, however, is not absolutely necessary because the slight amount of material that might be forced out can easily be sponged away.

I now remove the forceps from the stomach and open the jejunum (Fig. 412, 15). The clamps first applied to the stomach are removed in order to permit this portion of the stomach to be included in the bite of the three-bladed forceps just applied to the jejunum. Then mouse-toothed forceps are applied to the edge of the stomach wound (Fig. 412, 15), and smaller forceps are applied to the edge of the wound in the jejunum (not shown in illustrations). A line of sutures of fine chromicized catgut or silk is then carried through the incision posteriorly, uniting all the layers of the stomach wall to the wall of the jejunum (Fig. 412, 15). After this line of suture has reached the opposite end, it is continued in the form of a Connell suture until the beginning of this suture is reached (Fig. 412, 16). In this way the serous surfaces of the intestine and stomach wall are both inverted continuously. It is quite likely that this is the only suture that is necessary, but in hundreds of these cases we have reinforced this by an additional Lembert suture of fine silk or fine chromicized catgut, which is a continuation of the first row of the Lembert sutures applied posteriorly (Fig. 412, 17). This is continued to the point of the beginning of the first suture, where it is tied. At both ends of the suture line a few additional interrupted sutures are inserted in order to make sure that any slight deformity at these points may be corrected. The colon is then lifted up and the jejunum and end of the stomach are

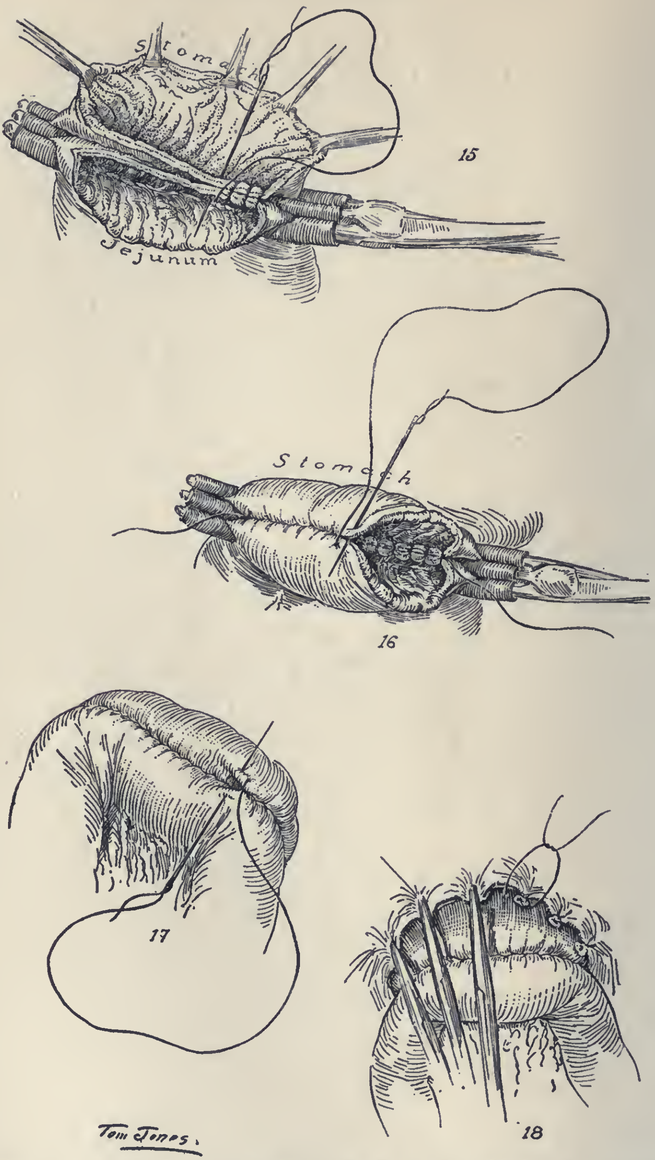

Fig. 412.—Duodenum and stomach now in the grasp of a three-bladed clamp; the forceps which at first controlled the stomach has been removed, the jejunum has been opened, and a through-and-through suture has been started (15). The through-and-through suture is continued anteriorly as a Connell stitch (16), and then the Lembert is completed anteriorly (17). The stomach is then stitched to the edges of the hole in the transverse mesocolon according to the method of Turner (18).

drawn down through the opening in the transverse mesocolon, and the latter is sutured to the stomach wall (Fig. 413, 19). These sutures are applied according to the method introduced by Mr. Turner. We catch the edge of the tear in the mesocolon in the bite of hemostatic forceps and place silk sutures at a distance of 1½ cm. in the wall of the stomach, and then simply tie

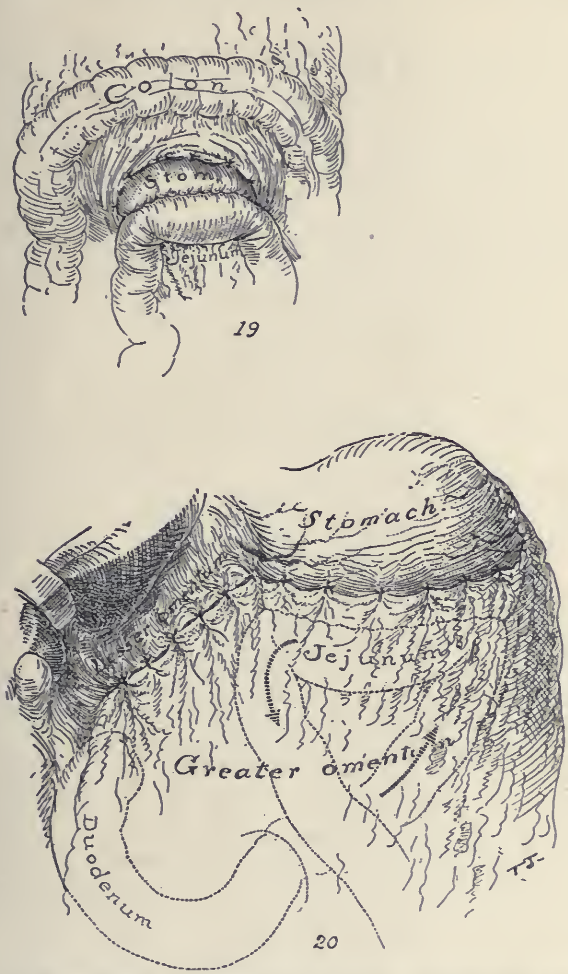

Fig. 413.—The operation completed (19 and 20). Arrows indicate the direction of travel of the gastrojejunal contents.

these over the bite of the mesocolon caught in the hemostatic forceps, in this manner avoiding the necessity of puncturing the mesocolon with the needle (see Fig. 412, 18).

The operation is now completed (Fig. 413, 19). The transverse mesocolon supports the wall of the stomach and prevents the jejunum from being pulled up above the colon. The greater and lesser omentum are sutured with interrupted sutures (Fig. 413, 20) and the omentum is dropped down over the jejunum.

This operation is suitable especially in cases like the one before us, in which the stomach is not greatly dilated. In case the stomach is greatly dilated, the opening in the stomach can be reduced by the application of interrupted Connell sutures (Fig. 414), in order to reduce the size of the opening at the end of the stomach to about 7 cm. in length. Such an operation is not as satisfactory as the one we have just completed, because it leaves a treacherous point at the angle where the line of suture reducing the size of the opening of the stomach joins the suture line of the gastro-enterostomy. This angle should be covered with a piece of omentum in order to protect the weak point. In cases of this character we prefer to make a posterior gastro-enterostomy after closing the end of the stomach with two rows of sutures.

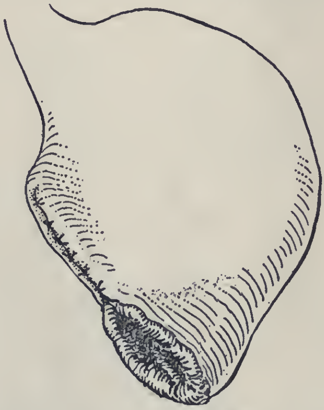

Fig. 414.—Occasionally the transverse section of the stomach may be too great to permit anastomosis by the method described. In such an event the size of the opening may be reduced as indicated.

GASTROSTOMY FOR CARCINOMA OF THE CARDIA AND LOWER ESOPHAGUS

Summary: Obstruction at the cardiac end of the esophagus; failure of treatment by bougies; exploratory laparotomy—palliative gastrostomy—technic.

History.—The patient, a male, aged forty-nine years, was admitted to the hospital May 4, 1919, complaining of regurgitation of food and loss of weight.

Two and a half months ago patient swallowed one-third of a toothpick. He states that he felt the two points of the toothpick and localized them under the ensiform cartilage. Following this he had some difficulty swallowing solid food; this became more marked about three weeks ago. At the present time he cannot keep any solid food on his stomach and has lost 20 pounds in weight. There is no blood or pus in the regurgitated food. The food has the same appearance when regurgitated as when eaten and is not sour.

His past and family histories are negative.

Examination.—A barium meal was given and an *x*-ray plate made. This showed heart and lungs normal. The barium meal was retained in the esophagus in a large saccular dilatation involving the lower and middle third of the esophagus. Marked cardiospasm was present and only a small portion of the barium entered the stomach. The stomach showed no gross lesions; pylorus emptied normally; duodenal cap normal. The patient regurgitated 2 ounces of barium held in the esophagus.

Physical examination showed no tenderness over the appendix, gall-bladder, or duodenum. Maximum pain point was over the cardia of stomach.

Diagnosis.—Ulcer of cardiac orifice and lower third of esophagus and persistent cardiospasm.

The history of having suffered from the present condition immediately after having swallowed a portion of a tooth-pick and the fact that almost immediately after this accident the patient began to have difficulty in swallowing food, and further, that this difficulty has continued to get worse until the time when the patient came under our care, and the further fact that after our attempt at passing an esophageal bougie, the patient vomited about one-half an ordinary tooth-pick, causes us to suppose that in all probability the obstruction must be due to the presence of an ulcer or abscess at the point at which the esophagus passes through the diaphragm, notwithstanding the fact that the *x*-ray picture shows an obstruction such as we find in carcinoma of the esophageal end of the stomach occluding the cardia. The patient succeeded in swallowing a small shot at the end of a silk thread with which as a guide esophageal bougies to the size of ½ cm. were passed. Later we passed a tubular bougie through which it was possible to introduce food into the stomach for nearly a month. We had hoped that by the use of this bougie, which was left in place, the patient's nutrition would greatly improve and that drainage of the abscess resulting from the use of this bougie might result in sufficient amount of healing, so that nothing further would be required than repeated dilatations by bougies. However, ten days ago this bougie was expelled, and we have since tried to replace it, but have not been successful. We have been able to pass smaller bougies through the stricture, so that he has taken a fair amount of liquid nourishment, but he is losing in weight, and unless we succeed in supplying means of feeding him his strength will soon give out, so that he will not bear any operation which might become necessary. We have, consequently, decided to make an exploratory operation and examine the condition, and in case we find an inflammatory condition, to open the stomach and to pass a bougie carrying a double braided silk thread through the stricture; by means of the thread we can then pull a little rubber tube through the stricture and out of the gastrostomy opening. This can be followed by larger and larger pieces of tubing until adequate dilatation has been secured (Fig. 415). In the meantime it will be possible to supply nourishment through the gastrostomy opening.

We will make our usual midline incision (Fig. 416, 1, *A*) in order to expose the stomach and lower end of the esophagus. To our disappointment we find the tumor to be a carcinoma involving the lower end of the esophagus and continuing over the lesser curvature of the stomach for a distance of 2 cm. and over the greater curvature of the stomach for a distance of 10 cm.

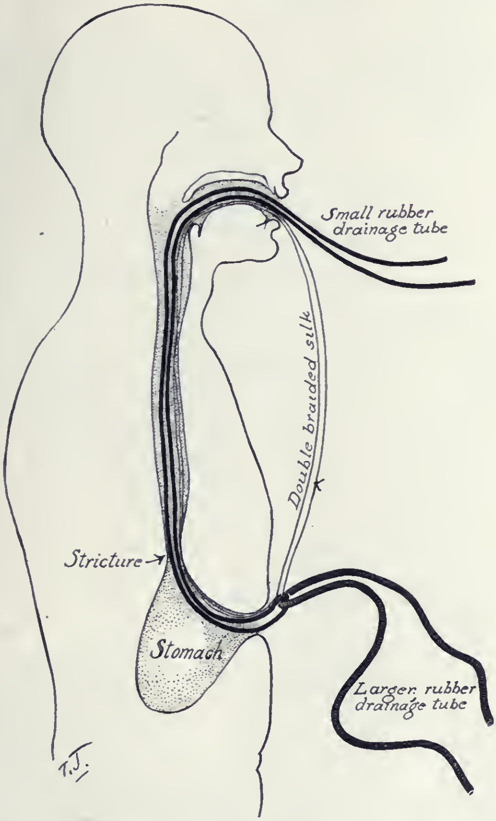

Fig. 415.—Method of dilating inflammatory stricture by retrograde passage of rubber tubing.

(Fig. 416, 4). This makes the case absolutely hopeless for surgical relief and all that it is possible to do will be to provide a gastrostomy opening through which nourishment can be supplied in order to prevent starvation. The carcinoma will, of course, progress and destroy the patient's life in a relatively short time. The end to be accomplished by this operation consists in supply-

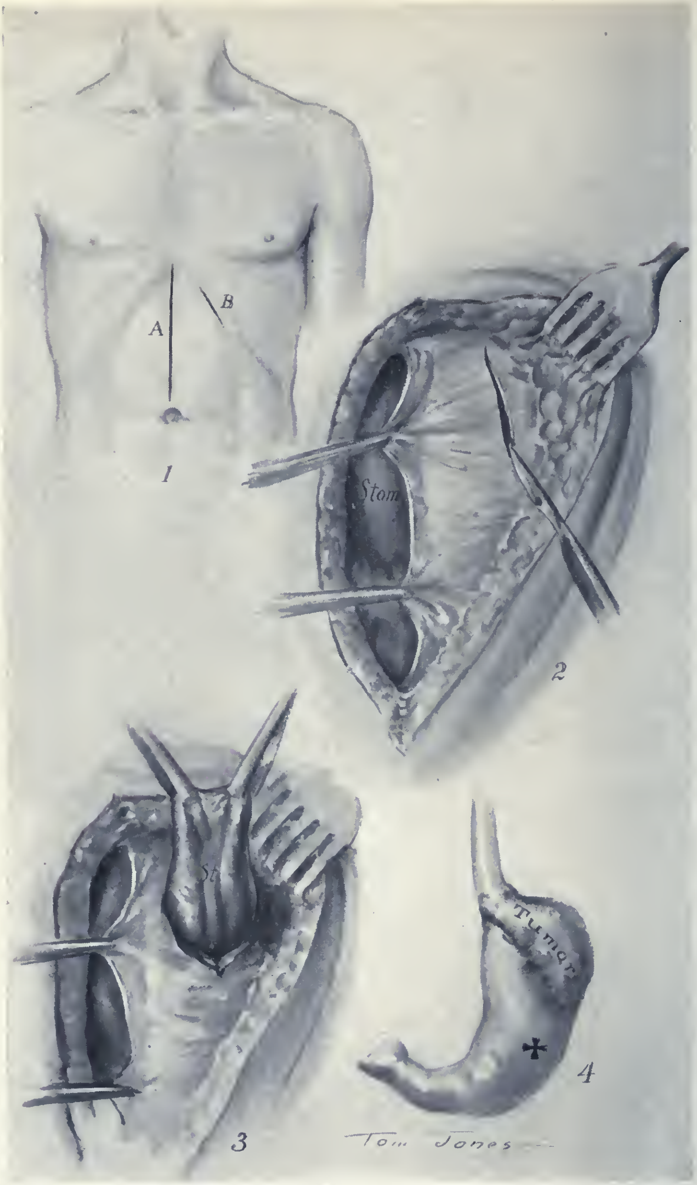

Fig. 416.—1, *A*, Midline incision; *B*, small incision along costal border for gastrostomy opening. 2, Incision being made through the rectus fascia and muscle 4 cm. long. 3, A portion of the stomach brought out through the smaller incision. 4, Diagram of the stomach showing extent of tumor and the point (cross) at which gastrostomy was made.

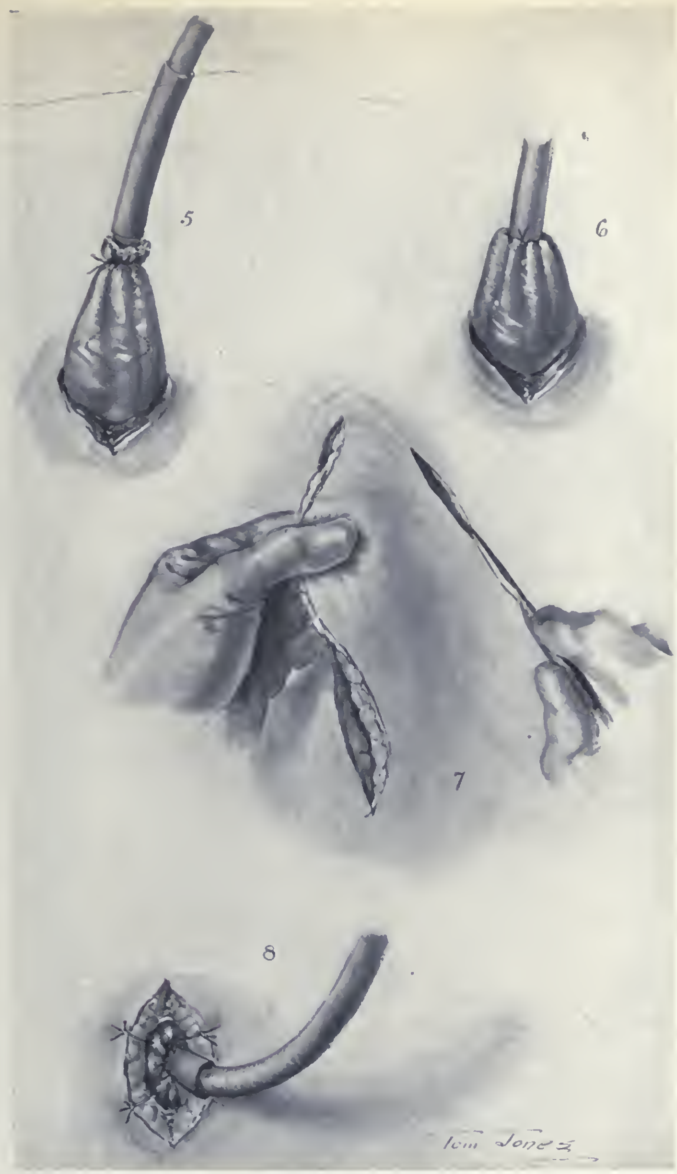

Fig. 417.—5, A rubber retention catheter has been prepared with another piece of rubber tubing, slightly larger in diameter and 8 cm. long, slipped over the catheter to the point shown. A purse-string suture has been applied on the stomach, a small incision made, and the catheter inserted, and the purse-string tightened and knotted. 6, A second purse-string has been applied so as to invaginate and bury the first. 7, Incision made through the skin and subcutaneous tissues. (Compare Fig. 416, 1, *B*). 8, The catheter held in place by interrupted sutures passing through the outer tube and the stomach. Stomach stitched to skin.

ing an opening in the stomach which will remain free from carcinomatous involvement, which will not leak so that the stomach contents may not be forced out over the abdominal wall, and which will not give rise to any marked degree of discomfort.

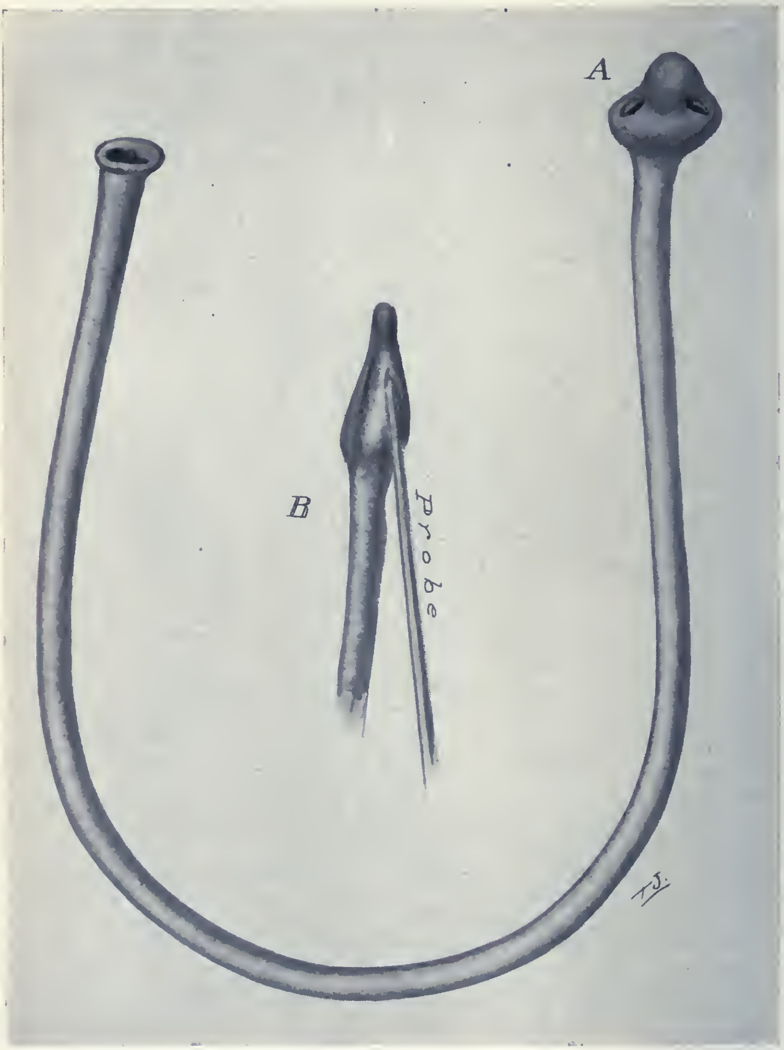

Fig. 418.—*A*, Jacobs' catheter. *B*, Probe passed through eye of catheter to serve as a carrier when catheter is to be placed in position.

We must, consequently, select an available portion of the stomach at sufficient distance from the edge of the carcinoma to prevent invasion by this disease. We will select a point near the lowest portion of the greater curvature of the stomach at a distance of 15 cm. from the edge of the tumor. We will grasp this by means of a pair of mouse-tooth forceps. We will then select a place on the abdominal wall so as to expose the aponeurosis of the external oblique abdominis muscle. We will make an incision through this aponeurosis just below the margin of the ribs, 5 cm. long, splitting the rectus abdominis muscle and underlying transversalis fascia and peritoneum (Fig. 416, 2). We will then draw a cone of the stomach wall grasped by mouse-tooth forceps through this opening (Fig. 416, 3). Then we will make an oblique incision through the skin 3 cm. above the opening in the aponeurosis (Fig. 417, 7). We now make a small opening at the point grasped by the mouse-toothed forceps just sufficient to pass a Jacobs catheter (Fig. 418). In order that the tube may fit the opening in the stomach snugly we then place a piece of rubber tubing over the Jacobs catheter in order to fasten this to the wall of the stomach without interfering with the lumen of the catheter. The stomach wall is now folded in by the use of silk sutures (Fig. 417, 5, 6) and fastened to the catheter by means of further sutures (Fig. 417, 8). The catheter with the stomach attached is now passed through the opening in skin and the stomach wall is sutured to the edge of the skin. This will make a perfectly water-tight closure of the stomach. A small cork introduced into the end of the catheter will suffice to prevent any leakage from this, and through the catheter an abundance of food can be supplied to the patient The abdominal wound is now closed in the usual manner.

CLINIC OF MAJOR HERBERT A. POTTS

U. S. A. General Hospital No. 28, Fort Sheridan, Illinois

NON-UNION OR FIBROUS UNION OF FRACTURE OF THE JAW

Summary: Cause of non-union—importance of exposure of roots of teeth in fracture lines; principles of treatment.

The two cases here cited show different results depending largely, in the first case, upon the location of the fracture and the possibility of applying a splint, thereby enabling the patient to masticate his food, while in the second case, the fracture being at the angle, a similar splint was impossible and mastication therefore impossible.

There are several causes of non-union, among them are: (1) syphilis; (2) lack of proper reduction of the fracture; (3) foreign bodies between the ends of the bone; (4) infection.

It is well known that a broken bone frequently fails to unite solidly if the patient is suffering from syphilis; this occurs in fractures of the jaw as in other bones, but the conditions about the mouth with all its bacteria favor infection, especially as most all fractures of the jaw are compound, and an infection of a fractured jaw in a syphilitic is always more destructive than in one free from lues.

Little need be said about the desirability of perfect reduction and retention of the fragments in perfect position.

The most usual foreign body to be interposed between the ends of a fractured bone is muscle or fascia, which in most cases must be removed before solid union can take place.

Under infection we must include infection about a special type of foreign body, viz., *the roots of teeth;* these roots, extending into the line of fracture, must almost invariably be removed, because after their peridental membranes are destroyed they continue to be infected foreign bodies and keep up an infective osteitis as long as they remain. Under this head also belong sequestra resulting from infection of comminuted fragments of bone; these must be removed before the infection will subside and allow healthy callus to be formed.

A general rule is that if a sinus persists after six weeks some pieces of dead bone must be removed, that length of time being required for the dead bone to be thrown off from the living.

This patient was injured in a train wreck in December, 1918. At that time a diagnosis of oblique fracture of the mandible (left) about 2 cm. from the median line was confirmed by Roentgen ray examination.

A cast metal splint held the fragments in perfect reduction. This splint was put on with cement at Base Hospital No. 64 December 15, 1918. Numerous small spicules of bone have from time to time been removed from the sinus. The splint was removed at this hospital on April 30, 1919. There was fibrous union; the x-ray showed lack of bone regeneration. Manipulation of the fragments elicited a false point of motion, and the lower left cuspid root extended into the line of fracture (Fig. 419). This together with the small fragments of dead bone kept up the infection. The principle cause of non-union, however, was the fact that the cuspid root, having lost its peridental membrane, afforded an open tract, and small though it was, it communicated with the mouth, and reinfection continually occurred. An incision exposed the sinus, granulation tissue was cureted away, the ends of the bone freshened, the cuspid tooth extracted, the wound and socket packed with iodoform gauze, and the splint replaced.

Result.—The splint was removed in three weeks; solid bony union was present.

The second case here presented is one of non-union due to the presence of fibrous tissue between the ends of the bone. Owing to the fact that the line of fracture lay behind the teeth and extended through the angle of the jaw, no splint capable of use for mastication could be constructed, and after the fibrous tissue had been removed and fragments wired, the jaws were wired in occlusion.

The history is as follows: P. W., private, 131st Infantry. Admitted February 6, 1919.

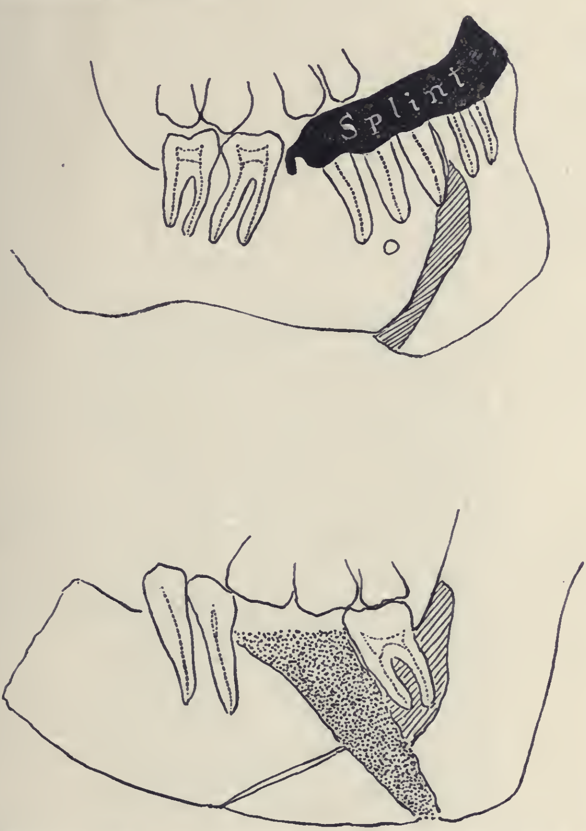

Fig. 419.—(*Upper*): Tracing from *x*-ray plate showing line of fracture with dental splint in place. Note tip of cuspid tooth exposed in line of fracture. (*Lower*): Tracing from *x*-ray plate showing comminuted fracture of lower jaw with non-union, due to lack of apposition of fragments and interposition of fibrous tissue between the ends of the bone.

Family History.—Mother died of cancer of stomach.

Personal History.—Negative.

November 10, 1918: Suffered shrapnel wound of right shoulder, also bullet wound of the face, the point of entrance being at the angle of the mouth on the right side. The point of exit was at the angle of jaw on right side, fracturing it. Examination of mouth revealed teeth in normal occlusion with the exception of the lower second molar, which was attached to the smaller posterior fragment, the larger posterior fragment being displaced outward. There was fibrous union only; movement, considerable.

x-Ray report: Comminuted fracture lower right jaw, oblique, 2 cm. in front of the angle upward to alveolar border; a second line of fracture extends from the middle of the first line forward to the lower border of the mandible (Fig. 419).

Before the operation angle bands had been placed upon the upper and lower teeth; on the second day after, the jaws were wired together.

Operation.—Incision to the site of fracture, fibrous tissue removed from between the fragments, bone ends freshened, better reduction secured, and bone fragments wired with silver wire.

Result.—The twisted ends of the wire which passed through the fragments were not bent down, and were cut off just beneath the level of the skin which grew over them. Four weeks later the wire was easily removed under a little infiltration anesthesia. The bony union was perfect.

MALUNION AFTER FRACTURE OF JAW

This patient had a tooth extracted July 14, 1918. The wound became infected and in consequence of it he lost considerable bone. The history states that he had two operations (resection). Evidently no splint was applied, the fragments were allowed to come together and bony union resulted with marked deformity. The most serious part of it is the loss of occlusion and ability to masticate his food.

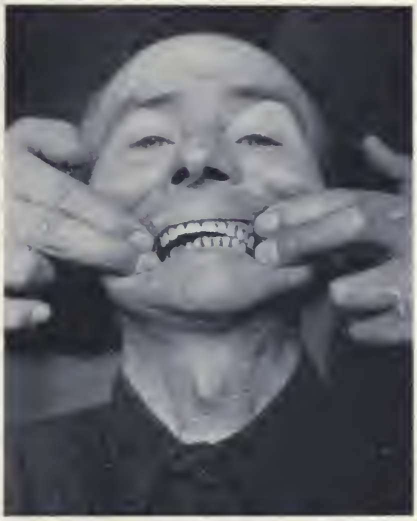

Fig. 420.—Showing typical scissors-bite.

The accompanying photograph (Fig. 420) shows a typical scissors-bite, the only teeth which are in occlusion are the first bicuspids above and below on the left side, this being the side upon which the loss of bone occurred.

It would be a simple procedure to restore his occlusion perfectly and correct the deformity of his face by sawing through the bone on a line parallel to the lower border of the jaw for about an inch, then at the posterior extremity of the primary saw-cut extend the saw-cut upward through the alveolar process; the saw-cut would then be completed by sawing through the lower border of the jaw at right angles to the original cut at its anterior extremity. The anterior fragment could then be slipped over into perfect occlusion and the bone fragments held together for a time by a wire suture.

The patient, however, objects to further operative procedures.

CORRECTION OF DEFORMITY FOLLOWING LOSS OF UPPER LIP AND ANTERIOR PORTION OF UPPER JAW

Our next patient sustained a gunshot wound of right shoulder and right side of face while in action at Villers Bretonneux on August 4, 1918. Was evacuated next day to Portsmouth, England, where a complete upper lip was constructed and the right corner of the mouth closed, two operations being required.

He was admitted to General Hospital No. 28 on March 22, 1919. Diagnosis: Gunshot wound of right side of mouth. Fracture, compound comminuted, superior maxilla, healed. Gunshot wound of right shoulder anteriorly, healed. Radial nerve injury with resulting paralysis.

Physical Examination.—Scars of upper lip showing repair of whole lip by means of skin-flaps, therefore no motion of lip possible. Upper teeth and bone of upper jaw missing from first molar on left side to corresponding molar on right side. Size of mouth very much reduced. Right angle of mouth retracted downward and outward by an extensive scar.

An operation was planned with the idea of enlarging the mouth and correcting the deformity. As a preliminary procedure a vulcanite plate with a clasp about the first molar was made to restore the contour of the upper lip. This was a difficult process. Because of the very small mouth the impression had to be taken in two parts; it was, however, successfully accomplished by Major Snap of the Dental Corps. It was necessary to enlarge the mouth, also necessary to remove the scar tissue. This enabled us to place the plate in the mouth, thereby restoring the contour of the upper lip. The technic of the operation by which we enlarged the mouth is shown in the accompanying sketches (Fig. 421, 1 to 4). In the repair of the angle of the mouth the mucous membrane of the inside of the cheek was sutured to the skin.

Now that the mouth is larger, a plate with teeth will be constructed and the contour of the lip and mastication restored.

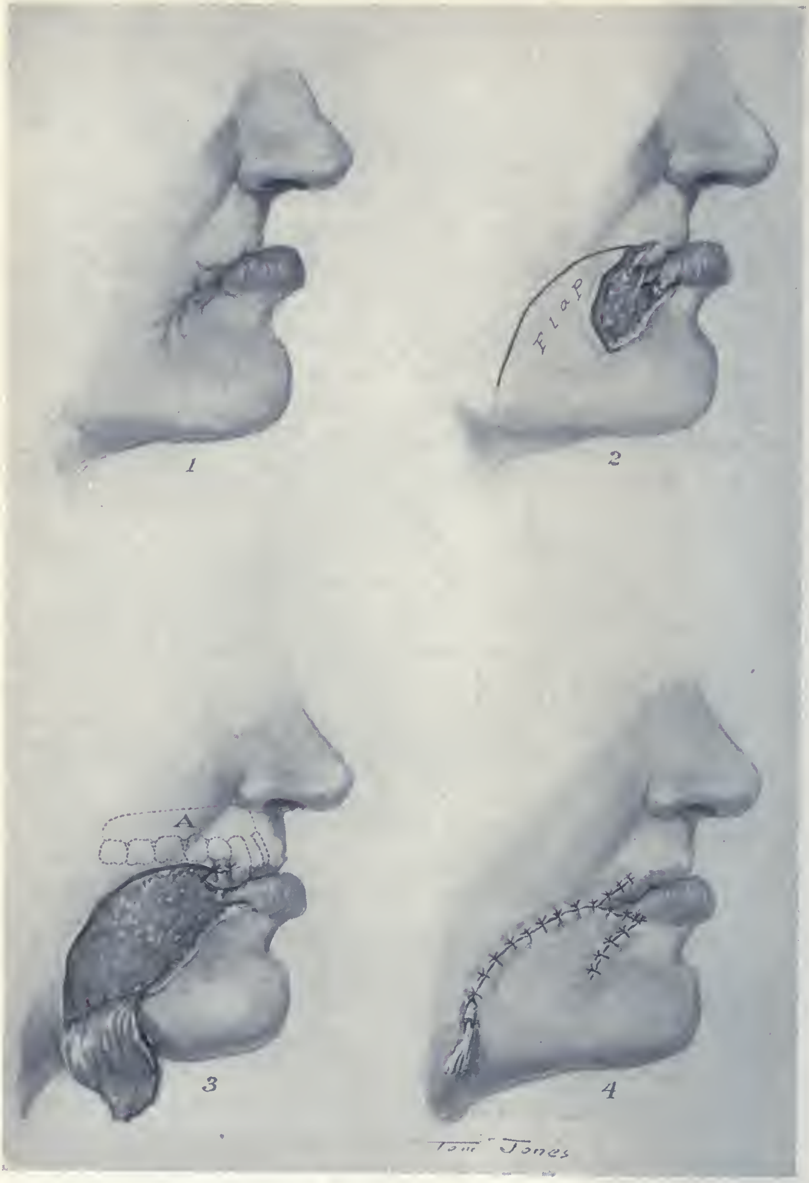

Fig. 421.—1, Condition prior to operation; the retraction of the upper lip is due to the extensive loss of the bone and teeth of the upper jaw. 2, Scar tissue dissected out and incision for the flap outlined. 3, Flap dissected up; wound ready for closure. 4, Flap sutured in place, elevating the corner of the mouth.

PLASTIC OPERATION RESTORING THE LOWER EYELID, MAKING THE INSERTION OF AN ARTIFICIAL EYE POSSIBLE

On October 15th, while in action, this patient sustained a gunshot wound which resulted in the loss of his left eye and lower eyelid. A machine-gun bullet entered below and posterior to the *right* mastoid, coursing along the base of the skull in an upward direction, emerging from the *left orbit,* destroying the left eyeball and lower lid, and in its course destroying the sense of hearing in the right ear, and causing paralysis of the right side of the face and right side of the tongue by cutting the respective nerve trunks. Such was his condition upon entrance to the hospital, and, in addition, a scar of considerable size drew the parietal conjunctiva of the lower lid down on his cheek (Fig. 422, 1).

Operation.—An incision was made along the border of the conjunctiva, the scar tissue being dissected out (Fig. 422, 2). It was found that a very small piece of the cartilage near the inner canthus remained, and this, together with some fibers of the orbicularis, was elevated (Fig. 422, 3). The removal of the scar tissue released the tissues and widened the palpebral fissure. An artificial eye (there being no bulbs available) was inserted, and a flap from the temple swung down as a substitute for the lower lid and to fill in the space made by the removal of the scar tissue (Fig. 422, 4). The wound in the temple was closed down to the base of the flap, the raw surface of the flap resting upon the skin, no dressings were applied, and the wounds healed without infection; the horsehair sutures were removed at the end of six days (Fig. 423, 5).

Two weeks later, under a local anesthetic, the base of the flap, the under surface of which was covered with epithelium, was cut away and the normal contour of the parts restored (Fig. 423, 6, 7). Upon effort to close the eyes there is some

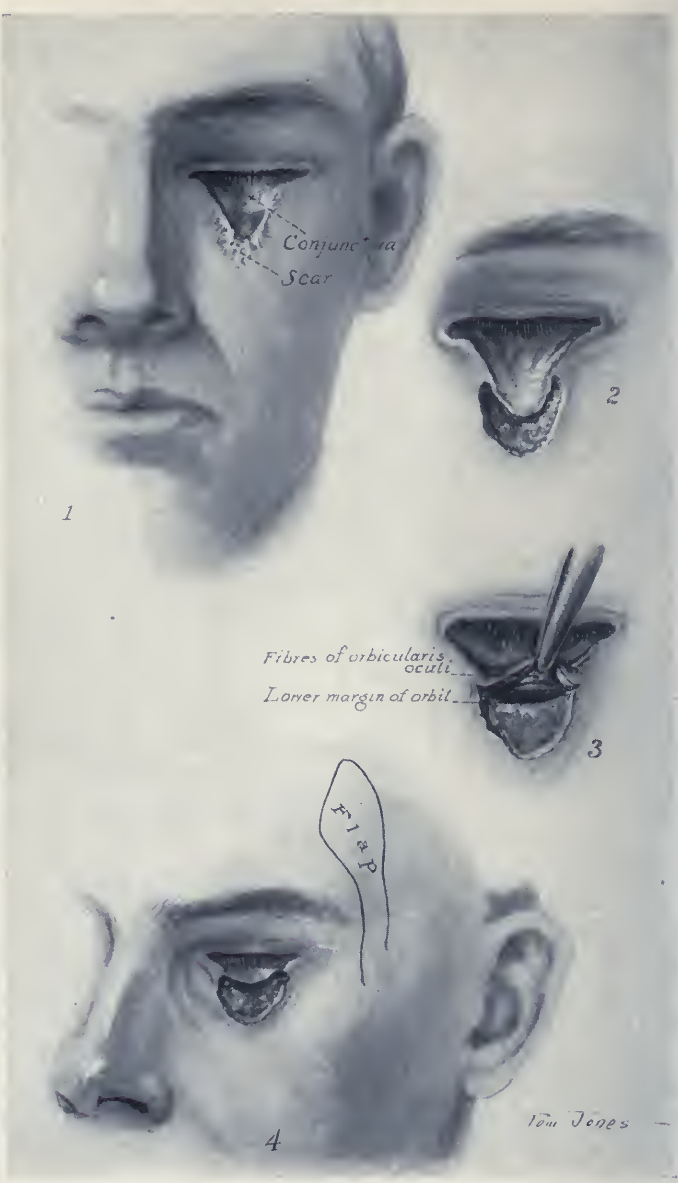

Fig. 422.—1, Condition when the case was first seen: The conjunctiva is drawn down by contracted scar, the lid having been destroyed. 2, After dissection of the scar. 3, Elevation, by blunt dissection, of some fibers of the orbicularis and the remnant of palpebral plate. 4, Incision for the flap.

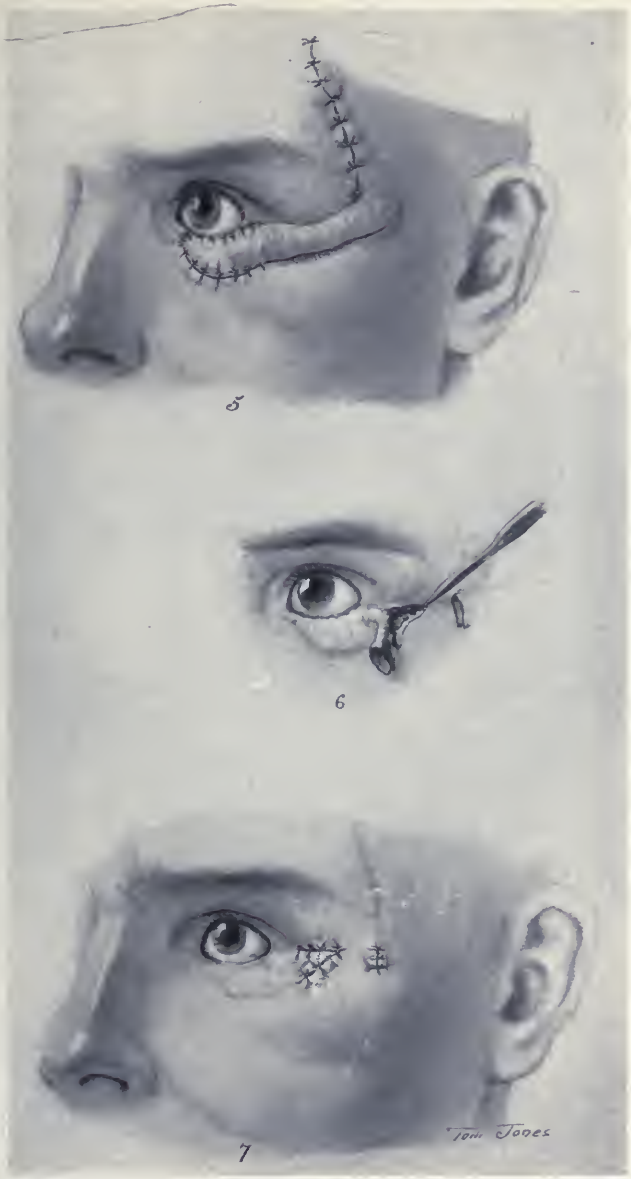

Fig. 423.—5, Suture of the flap in place and closure of the wound. 6, Cutting the pedicle. 7, Closure of the wounds.

movement in the lower lid; it seems that within a month he will be able to close the eye completely. In studying the case before operation there were several methods of procedure which suggested themselves; it was necessary to restore the socket in order that an artificial eye might be retained. The loss of tissue was too great to permit, by linear incision, the sliding over of the tissues overlying the zygoma, and the V- or Y-shaped incision was deemed inadequate also. In addition, as two unsuccessful attempts to utilize Wolff grafts, taken from the foreskin while the injury was fresh, had been made, it seemed that the method chosen offered the best prospects of success, and the result has justified our choice.

APPARATUS FOR MAKING TRACINGS OF *x*-RAY PLATES

Before concluding this clinic I wish to show you a simple apparatus which fills what to some of us has been a long-felt need. This apparatus is simply a box with a ground-glass top containing an electric light (Fig. 424). The long wire attachment enables one to use it almost anywhere; it can be taken to the operating room or one's office, and used as a viewing screen.

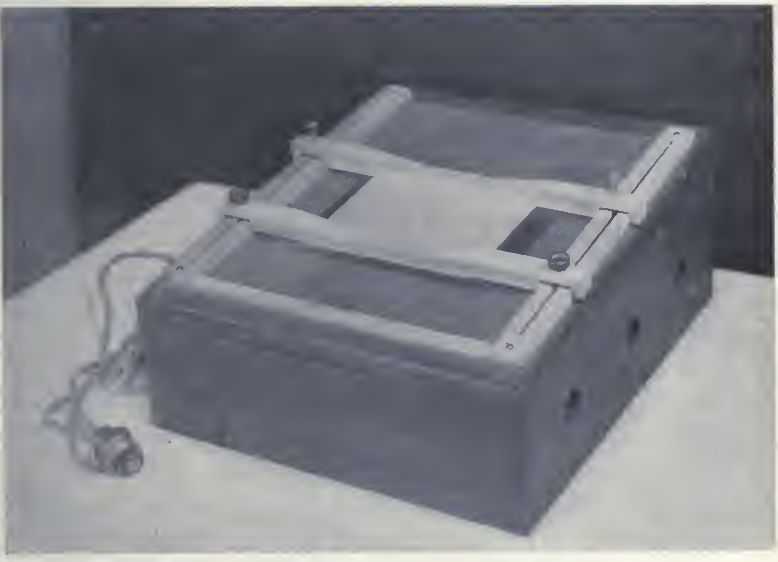

Fig. 424.—Apparatus for making tracings of *x*-ray plates.

The purpose for which it was made primarily, however, was to make tracings of *x*-ray plates upon onion-skin paper. This can be done quickly in colors, if it is so desired, or India ink may be used.

To one not perfectly familiar with a plate it is often difficult to point out upon the plate the pathology revealed on account of shadows cast by extraneous parts, and for purposes of illustration a semidiagrammatic copy of the plate is often best.

I think very few surgeons can form complete and adequate conceptions of existing conditions from the report of the roentgenologists; at any rate, they would rather see the plate than be guided by the report. It is not always convenient or easy to go to the filing room or viewing room to look at plates, and as one frequently wants to see a plate repeatedly, if a tracing of each plate could be attached to the history one could instantly refresh one's memory of the case.

For teaching purposes the ordinary lantern-slide made from a reduced *x*-ray plate is many times quite unsatisfactory on account of the extraneous shadows.

One can take used or spoiled celluloid films, and by washing the emulsion from them render them transparent. These can be cut into lantern-slide sizes and the tracings made upon them; they can then be mounted between lantern-slide glasses and used in the stereopticon.

CLINIC OF MAJOR ALBERT H. MONTGOMERY

U. S. A. General Hospital No. 28, Fort Sheridan, Illinois

GUNSHOT FRACTURES OF THE INNOMINATE BONE

Summary: Presentation of four cases illustrating results of gunshot injury of innominate bone—determining factors—importance of location of injury and type of missile producing it; discussion of the general principles of treatment.

In civil practice fractures of the innominate bone are usually due to a crushing or bending force. As a result the pelvic ring is broken, generally at its weakest point. Although they are simple fractures, in most instances, urinary infiltration and sepsis are apt to occur from rupture of the firmly attached urethra or adjacent bladder. Military surgery, however, encounters a different type of fracture of this bone. The force employed is a flying missile that produces a fracture at the immediate point of contact. Large outstanding portions of the bone like the ilium are most frequently injured. The continuity of the pelvic ring remains intact, and the bladder and urethra are not involved. However, these war fractures are compound, with all the dangers of sepsis, injury of the soft parts, and slow healing. Considering the number of injuries of the lower extremities that are caused by high explosive shells bursting on or near the ground, fractures of the innominate bone are comparatively few. The following cases occurring in soldiers of the American Expeditionary Forces are here presented.

Case I.—J. J. G., private, Co. A, 132d Infantry, injured July 4, 1918, by shrapnel on the Somme Front. He received seventeen wounds from the exploding shell; eleven in the right leg, two in the left leg, two in the right loin, one in the right foot, and one in the right buttock which produced a fracture of the ilium. A debridement operation was done the same day at a British Casualty Clearing Station. A few days later he was evacuated to England, where a shrapnel ball was removed from the right ilium July 16, 1918. All his other wounds progressed favorably, but on September 23, 1918 it was found necessary to curet the wound in the ilium. In December he was transported to the United States. December 28, 1918 the patient entered U. S. A. General Hospital No. 28, Fort Sheridan, Illinois. All of his wounds were healed except the wound in the ilium, and his general condition was fair. Over the right ilium extended an irregular scar with a discharging sinus at the outer angle. *x*-Ray examination January 23, 1919 showed a comminuted fracture of the right ilium just above the acetabulum, but not involving the joint surface. The fragments were in good position. An area of dense callus formation was present with a central cavity containing small sequestra and foreign bodies. Operation March 8, 1919: Sequestrectomy. Under ether anesthesia, a curved incision, extending from the right sacroiliac synchondrosis almost to the anterior superior spine allowed the soft parts to be retracted freely. A bottle-shaped cavity was found in the bone. This was laid open by free bone removal and thoroughly cureted. A tube drain was inserted, and the wound partially closed with interrupted silkworm-gut sutures. Subsequent course: Healing progressed favorably under daily dressings of gauze moistened in Dakin's solution, without irrigation. May 10, 1919 recovery was complete. The patient walked freely with a normal gait.

x-Ray examination July 9, 1919 showed a dense callus at the old site of fracture. The small sequestra and most of the foreign bodies present in the previous examination were absent.

It is noteworthy that the round shrapnel ball produced a wound without extensive damage to the soft parts, and probably carried in no pieces of clothing. Such a wound required only slight debridement and could be closed early. The fracture produced was not extensive, and the fragments were not displaced. Infection was mild and the necessary bone work resulted in prompt repair.

Case II.—O. J. S., private, Mg. Bn., 363d Infantry, struck by an explosive machine-gun bullet October 31, 1918 at the Belgian Front. He was picked up four hours later and taken to a First Aid Station where antitetanic serum was given. A few hours later he was moved to Evacuation Hospital No. 5, where he was operated on. The explosive bullet entered 1 inch in front of the posterior superior spine of the right ilium, and traveled forward through the muscles, fracturing the ilium at its anterior border. The track of the bullet widened as it passed forward. The crushed anterior portion of the ilium and the nose of the explosive bullet were removed at operation. An extensive debridement of the muscles over the outer surface of the ilium was found necessary.

The patient was evacuated to England, where he was treated at Base Hospitals for five months, and then transported to the United States March 18, 1919. He entered U. S. A. General Hospital No. 28. His wound at this time consisted of a raw, suppurating surface, extending the entire length of the wound track with three suppurating sinuses, extending into the bone at the anterior edge of the wound. The patient was wasted, anemic, and somewhat septic.

x-Ray examination showed an old comminuted fracture of the right ilium with marked bone destruction. The entire anterior border of the ilium was gone. One large and several small sequestra were present in the region of the bone sinus, a small foreign body was present in the soft tissues.

Operation May 26, 1919: Sequestrectomy. Under ether anesthesia the bone was exposed in the region of the sinuses and the sequestra removed. After thorough curetment the wound was dressed with gauze moistened in Dakin's solution.

Subsequent course: The patient's general condition has gradually improved. At present he is able to sit up, and should be on his feet before long. Flexion and extension in the leg are steadily improving, but there will undoubtedly be some impairment in abduction and rotation on account of the extensive loss of muscle. The suppurating wound has been replaced by a healthy granulating surface over which the skin is growing from the edges. *x*-Ray examination three months after operation shows absence of sequestra. Bone atrophy is very marked.

Unlike the smooth, round shrapnel ball in Case I, this explosive bullet, with its ragged, irregular shape, produced a severe, lacerated wound of the soft tissues with extensive fracture of the bone. Most of the fragments required removal. The necessary debridement was so large that delayed suture was impossible.

CASE III.—L. P., corporal, 127th Infantry, struck by piece of high explosive shell September 1, 1918, near Soissons. He was taken to Evacuation Hospital No. 5, where I happened to be operating at that time. The shell fragments entered the right buttock just behind the great trochanter and tore through the gluteal muscles, lodging in the region of the right sacro-iliac synchondrosis, and producing a fracture of the ilium at that point. The entire wound track was laid open, thoroughly debrided, and the shell fragment removed. The next day the patient was evacuated to Red Cross Military Hospital No. 1, where a ligation was done for secondary hemorrhage September 15, 1918. He arrived at U. S. A. General Hospital No. 28 March 19, 1919. His general condition was good and he was walking normally. His wound was healed, except for a discharging sinus at the posterior portion leading down to roughened bone.

x-Ray showed a fracture of the posterior portion of the ilium in the region of the synchondrosis with an area of lessened density, containing a large sequestrum.

Operation April 4, 1919: Sequestrectomy. Under ether anesthesia the sinus tract was incised and a sequestrum, the size of a large hazelnut, found lying free at the site of fracture. This was removed and the walls of the cavity leveled off to allow the soft parts to fall in. Gauze moistened in Dakin's solution was laid loosely in the cavity. Subsequent course: The wound was dressed daily with Dakin gauze. Healing progressed favorably and was completed June 1, 1919.

x-Ray examination made July 19, 1919 showed the bone cavity in the ilium filling with new bone. The large sequestrum shown in the previous examination was absent. In this case the crushing effect of the piece of high explosive shell was not sufficient to produce extensive destruction of the ilium at the point where it was strongly supported by the heavy sacrum. The missile simply lodged in the bone, producing a localized, comminuted fracture. The bone cavity was rather deep and required considerable leveling of the walls so that the soft parts could fall in and obliterate the cavity.

Case IV.—C. H., private, Co. B, 7th Infantry, struck by machine-gun bullet October 20, 1918, Argonne Forest. At the time of the injury the soldier was squatting behind a stump which evidently did not protect his buttocks. The bullet entered the right side about 2 inches from the anus, passed through the anal sphincter, entered the left buttock about 1 inch from the anus and passed through about parallel to the gluteal fold. He was taken immediately to Field Hospital No. 4, where the wound track on the right side was laid open and debrided. The wound orifices in the left buttock were excised.

In a few days he was sent to Base Hospital No. 28 and later to Base Hospital No. 141, and then transported to the United States. From the time of his injury he had no control over his bowel until December, when he gradually began to regain this function. May 10, 1919 he arrived at U. S. A. General Hospital No. 28 as a litter case. At that time a dirty, granulating fissure track was present in the right buttock. The wound in the left buttock was healed, but showed marked induration and some tenderness. The patient's general condition was fair and his control of the bowel almost normal. Under hot Sitz-baths treatment the fissure wound in the right buttock cleaned and healed rapidly. The left buttock, however, became more painful and indurated. May 25, 1919 a small abscess pointed in the scar in the left buttock and was incised. *x*-Ray taken at the time of entrance showed evidence of an old injury at the junction of the descending ramus of the left pubic bone, and the ramus of the ischium. Signs of osteomyelitis were present and ill-defined shadows of a possible sequestrum.

As the abscess track in the left buttock continued to discharge, it was deemed wise to explore this wound. Operation May 31, 1919: Sequestrectomy. Under ether anesthesia the sinus was laid open down to the injured bone. At the tuberosity of the ischium the sequestrum, the size of a hazelnut, was lying free and was readily removed. A rubber tube drain was inserted, and the wound partially closed with silkworm-gut sutures. Subsequent course: For the next week the patient suffered from a cellulitis in the region about the wound. This subsided satisfactorily under hot boric dressings. The drainage-tube was replaced then by dressings moistened in Dakin's solution. July 10, 1919 the wound healing was complete. *x*-Ray examination July 16, 1919 showed evidences of old osteomyelitis at the tuberosity of the ischium, but no sequestra.

The rapid traveling machine-gun bullet in this case just barely grazed the tuberosity of the ischium. A small, comminuted fracture with subsequent osteomyelitis was the result. The comparatively slight wound of the soft parts shows clearly that the explosive action of the bullet was practically nil.

The type of fracture produced in gunshot wounds involving the innominate bone has differed, depending on the part of the bone involved. Missiles striking the heaviest portions have produced comminuted fractures with stellate lines and a single large sequestrum, as illustrated in Case III. Where the bone is not quite so dense, as in the region of the acetabulum, a stellate fracture may result, but the sequestra are small, as in Case I. Fractures through the thin wing of the ilium are usually of the tunnel variety, a mere punched-out hole in the bone with no sequestra. If, however, the injury occurs near the superior or anterior edge of the bone, a portion may be blown off, as shown in Case II.

The closure of the bone cavities resulting from these fractures presents another problem. Those deep cavities with heavy walls, as in Case I, require craterization. The wall is chiseled off until it slopes sufficiently to allow the soft parts to fall into the cavity. The bottle-shaped cavity necessitates a free removal of one wall by the rongeur to permit obliteration of the space by the soft parts. In one of our cases the removal of a sponge, which had been left in the cavity in a rush operating period at the front, aided materially in closing a bottle-shaped cavity. The tunnel cavities may be healed by cutting out a pie-shaped piece of the ilium with the crest as a base and the apex embracing most of the wall of the tunnel. This procedure gives a rapid and satisfactory result. In general, gunshot wounds of the innominate bone appear to offer a good prognosis. The institution of proper drainage and the removal of dead bone to control the osteomyelitis, followed by some mechanical operation, as suggested above, to close the bone cavity, will give a good functional result in the majority of cases.

CLINIC OF DR. PAUL OLIVER

Cook County Hospital

CRUTCH PALSY

Summary: A patient with bilateral wrist-drop and evidence of injury to median and ulnar trunks following use of crutches; diagnosis; treatment, expectant; prognosis, good.

The patient, thirty-six years old, had the left leg amputated February 25, 1919, at another hospital because of a severe infection which developed subsequent to a compound fracture of both bones of the leg. He came to this hospital several weeks ago on account of a chronic ulcer at the end of the stump. A reamputation was performed and healing obtained.

Before leaving the hospital the last time, while about on crutches, he noticed some tingling and numbness of the left hand. After returning home he noticed some weakness of the hand, but persisted in the use of crutches for three days, when his grip became so weak he could no longer grasp the handles. The crutches were not padded.

He returns to us for the condition which you see (Fig. 425). He has never worked in lead and has not been a heavy drinker. There is wrist-drop on both sides. The fingers cannot be abducted one from the other, and the thumb and little finger cannot be brought into apposition. Flexion of the fingers of the left hand is absent and of the right hand very weak. The sensory disturbance is not marked.

This is a typical example of crutch palsy. As is usual, the musculospiral is the nerve most markedly involved. The ulnar is involved in both hands also and the median to a less degree. There can be no doubt that the paralysis in this instance is due to the pressure of the crutches in the axillæ crushing the brachial plexus against the humerus.

The prognosis is good, although it will take several weeks or possibly months for complete return of function. Massage and electricity are being used daily.

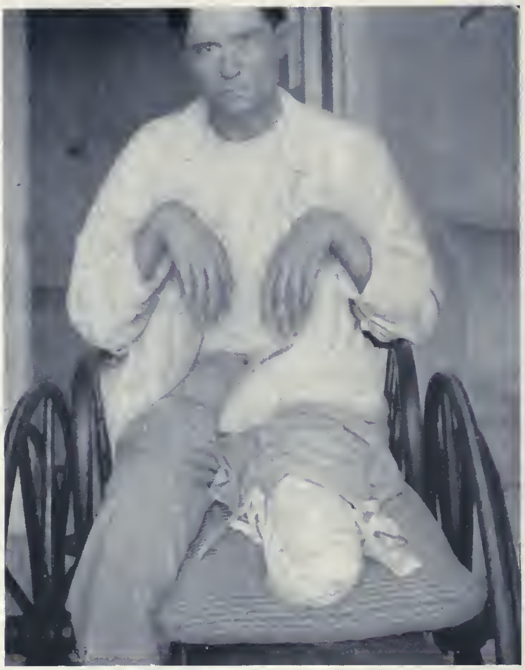

Fig. 425.—Bilateral wrist-drop in case of crutch palsy.

Note.—After three weeks there is only slight betterment of muscular power in the hands. Wrist-drop still persists on both sides.

FRACTURE OF SIXTH CERVICAL VERTEBRA

Summary: Brown-Séquard syndrome following a fall on the back of the head and neck; diagnosis, fracture of body of vertebra in unusual plane; hematomyelia; treatment by plaster-of-Paris cast; results to date.

The patient, a man twenty-four years old, fell backward from a porch May 17, 1919, striking the ground, a fall of about 11 feet. It is not known what part of the body struck the ground. He was picked up in an unconscious state and remained so for two hours. A doctor who examined him at this time found the left side paralyzed. He was brought to the hospital the following day.

He lay quietly in bed with head in a fixed position complaining of soreness of back and head, numbness of the left side, and inability to move the left lower extremity or left hand. His temperature was 100° F. There were scratches on the scalp. Both active and passive movements of the head caused sharp pain in the back of the neck. The neck and head were held rigid. Pressure over the sixth and seventh cervical spinous processes elicited pain. There was no deformity, swelling, or other indications of traumatism to the neck.

There was complete paralysis of the muscles of the left hand and forearm. The biceps and triceps were very weak, but the muscles about the shoulder seemed to be practically intact. Muscular power in the left lower extremity was very weak. The knee could be bent only slightly. Chest was negative—expansion symmetric. Abdomen was somewhat distended and tympanitic. There was no bladder or rectal disturbance. Sensation: Over the entire right side of the body from the nipple to the toes there was loss of temperature and pain sense. Tactile and muscle sense were retained.

Reflexes on right side of the body were normal. On the left there was absence of abdominal, cremasteric, patellar, and Achilles' reflexes.

x-Ray examination revealed a fracture of the sixth cervical vertebra, the body being broken into two halves in the sagittal plane. The right half was displaced laterally (Fig. 426). The lateral view showed collapse of the body of the vertebra with small fragments of bone projecting forward (Fig. 427).

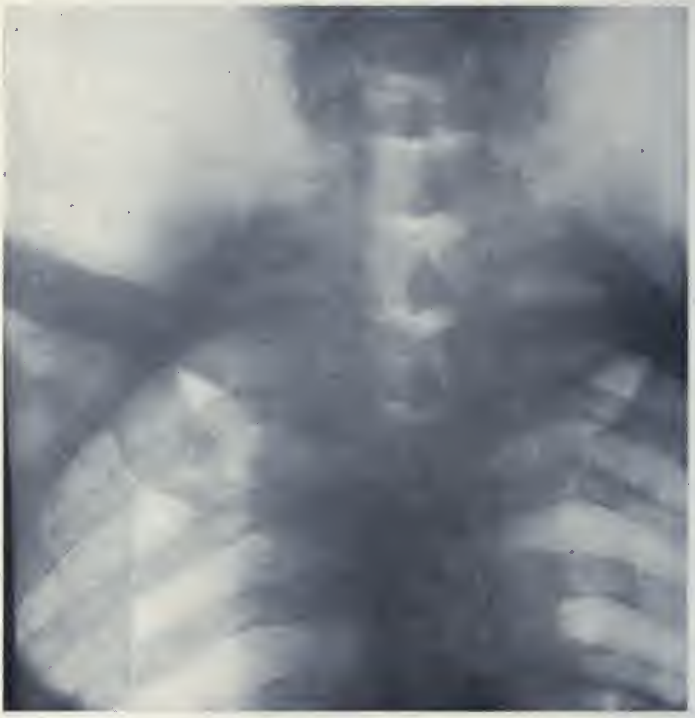

Fig. 426.—Fracture of sixth cervical vertebra with right half displaced laterally and upward.

A cast was applied, including the head, neck, and chest. This was removed after four weeks. There was rapid improvement of motor power of the left side, most marked of the lower extremity.

About one week ago he was allowed out of bed. At present, nearly eight weeks since the accident, he walks about a little, complaining of weakness of the left leg. There is some stiffness of the neck. On the left, the lower part of the pectoralis major muscle contracts poorly and shows atrophy. There is atrophy of the muscles of the arm. The triceps is very weak. Extensors of wrist and fingers are weak. Action of all small muscles of the hand is absent. There is atrophy of the thenar and interossei muscles. Muscular power of left lower extremity is diminished. There is no spasticity. Sensation of left side is normal.

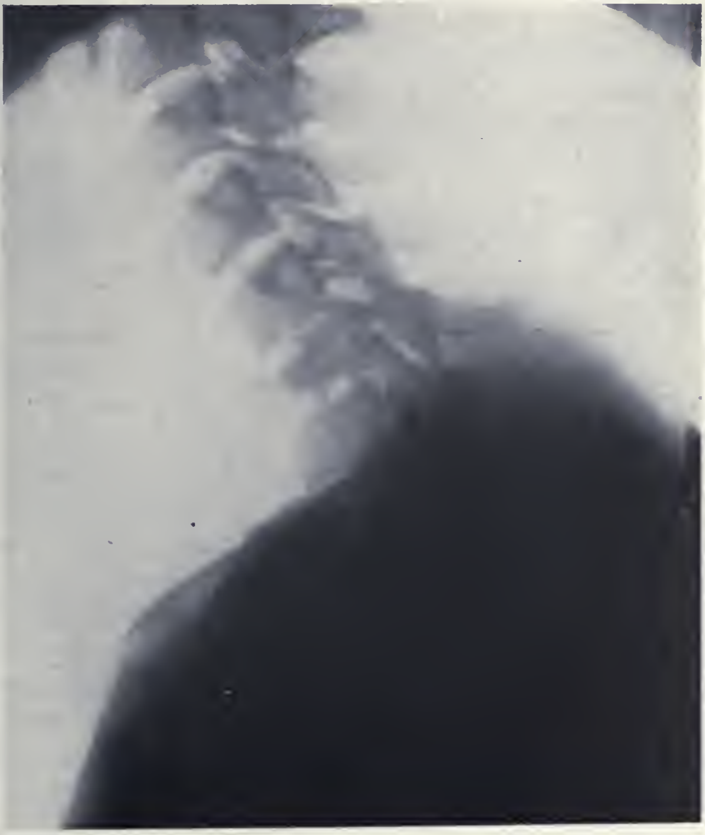

Fig. 427.—Crushing of sixth cervical vertebra with fragments displaced anteriorly.

On the right side from the tenth rib down there is loss of temperature and pain sense, with retention of tactile, pressure, and muscle sensation. On the left, there is absence of abdominal and cremasteric reflexes. Patellar and Achilles' reflexes are exaggerated and ankle-clonus is present. There is no Babinski.

This case is unusual because of the type of fracture. Although the sixth cervical is one of the vertebræ most frequently fractured, it is not common to find the body split into two halves in the sagittal plane. Fracture of this vertebra with injury to the cord often results fatally.

The other unusual feature is the type of cord lesion, which represents a hemisection giving rise to motor paralysis on the same side below the lesion, with loss of temperature sense and pain sense on the opposite side. This is the Brown-Séquard syndrome. It is usually due to destruction of one-half of a certain level of the cord by knife or bullet.

The transient motor paralysis of the left leg, persistence of left-hand paralysis, loss of pain and temperature sense on the opposite side and reflexes on the left below the lesion at first lost, later to be regained, indicate the pathology in this case to be a hemorrhage into the cord—hematomyelia. According to Balton (Annals of Surgery, August, 1899) hematomyelia occurs usually in the gray matter and almost exclusively in the lower cervical and lower dorsal regions. These represent the most freely movable parts of the spine, allowing overstretching of the cord with resulting hemorrhage into its substance.

The prognosis of the paralysis of the left hand is not good, for it is believed that the spinal nuclei in the gray matter governing these muscles have been destroyed by the hemorrhage.

FORWARD DISLOCATION OF ATLAS ON AXIS

Summary: A patient complaining of stiff neck, with pain and tenderness on the left side of the head and neck; *x*-ray diagnosis of dislocation of atlas; reduction under anesthesia.

This man walked into the hospital complaining of pain and tenderness of the left side of the head and neck, with marked stiffness of the neck. He is twenty-eight years old and a piano-mover by occupation. He states that on June 28, 1919, he made a misstep and fell to the ground, striking his forehead on the right side. He was able to get up and walk home and felt no discomfort. June 30th his neck began to get stiff and sore. Application of liniment and hot dressings relieved the pain after several days. July 3d the pain returned on the left side of the neck and behind the ear. It has grown gradually worse and is especially severe at night.

Examination.—It is now two weeks since the fall. You note that he is a well-nourished young man who holds the neck very rigid, that the chin is markedly depressed toward the sternum, and turned slightly to the right. The left side of the neck appears somewhat swollen. To palpation there is tenderness behind the left ear and down the side of the neck. The deep muscles on this side of the neck feel swollen and are very hard. The trapezius and sternomastoid muscles are normal. The posterior chain of cervical glands are enlarged. The second cervical spinous process feels prominent.

Movements of the head are very limited and painful. The head can be turned and bent slightly to the right. There is a small abrasion of the scalp on the right side above the temple.

When we examine the *x*-ray plates there is seen a forward dislocation of the atlas on the axis (Fig. 428). Comparing this plate with that of a normal cervical spine, we see that in the latter the tubercle of the anterior arch of the atlas is in the same anterior plane with the anterior surface of the bodies of the other cervical vertebræ (Fig. 429), while in this case the tubercle is definitely in advance of this plane.

It is probable that this is a partial dislocation and unilateral. Authorities state that forward dislocation requires either fracture of the odontoid process of the axis, fracture of the strong transverse ligament, or slipping of the process under the ligament. Stimson says that dislocation of the atlas forward is rarely complete except in immediately fatal cases. In this case

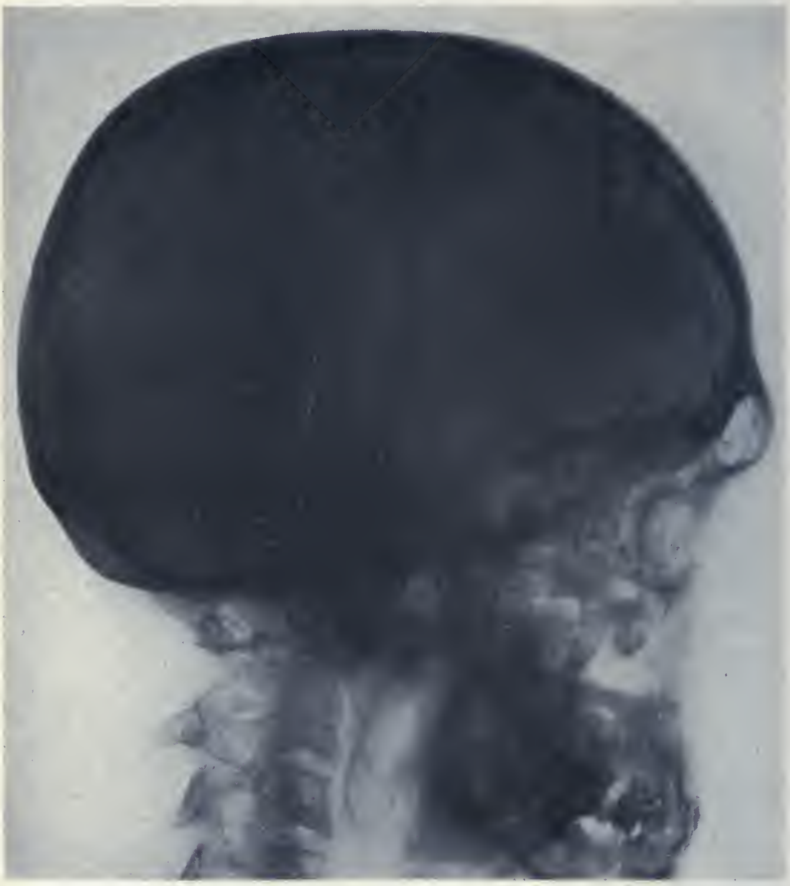

Fig. 428.—Dislocation of atlas on axis. The tubercle of anterior arch of atlas is seen in advance of the bodies of the other vertebræ.

the upper cervical nerves are irritated only on the left side, as evidenced by spasm of the deep muscles and pain behind the left ear. Although the injury occurred two weeks ago, we propose to attempt reduction under anesthesia by gentle manipulation.

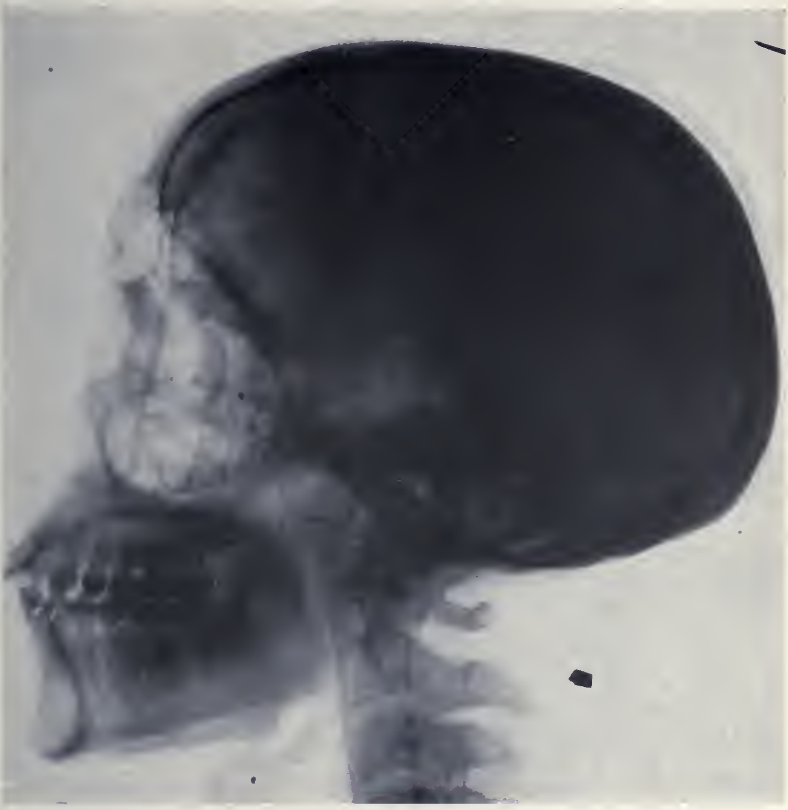

Fig. 429.—Normal cervical spine for comparison with Fig. 428.

Note.—The patient refused to allow an attempt at reduction, and went home stating that he felt well except for stiffness of the neck.

SILENT CARIES OF THE SPINE

Summary: A patient with a symptomless swelling of the back of six months' duration; pus withdrawn through aspirating needle; *x*-ray diagnosis of caries of spine with cold abscess.

The patient, a laborer thirty-three years old, comes to the hospital because of a swelling of the back. He states that this appeared suddenly six months ago, growing to its present size overnight. At that time he first felt pain in the back below the angle of the right scapula. The pain was brought on by heavy lifting and he had to quit work on account of it. He further states that the hands and feet became swollen about the same time and there was frequency of urination.

He was treated at this hospital in November, 1918, for chronic skin disease of the face, which was diagnosed blastomycosis. Denies luetic infection and does not use alcohol. He has lost about 25 pounds during the past six months.

On examination we see that this man is of slender build, apparently somewhat emaciated. He is about the ward and says that he feels well and has a good appetite. His face is scarred over the nose and both cheeks, giving the appearance of a healed lupus vulgaris. Just below the angle of the right scapula is a prominent swelling about the size of a small orange. The skin is normal and movable over it. It is not tender to manipulation and is firmly attached to the deeper structures by a broad base. It gives a sense of fluctuation to palpation. There is no lobulation or puckering of the skin when the swelling is pushed to one side, practically ruling out a soft lipoma. Aspiration yielded a thick yellowish pus, the cultures from which remained sterile after twenty-four hours. Smears were stained for tubercle bacilli with negative result. Examination for blastomyces was also negative.

Considering the possible origin of this cold abscess, it might be an empyema necessitatis, but examination of the chest is negative and there is no sputum. The other two possible sources are tuberculous rib and Pott's disease of the spine. x-Ray examination should differentiate. Plates were made which show a rarefaction of the body of the sixth thoracic vertebra with a large abscess of this region (Fig. 430). Further examination for signs of Pott's disease shows no deformity of the spine; on bending forward there is slight rigidity of the thoracic spine; no pain is produced by sudden jar by pressure on the head, but firm

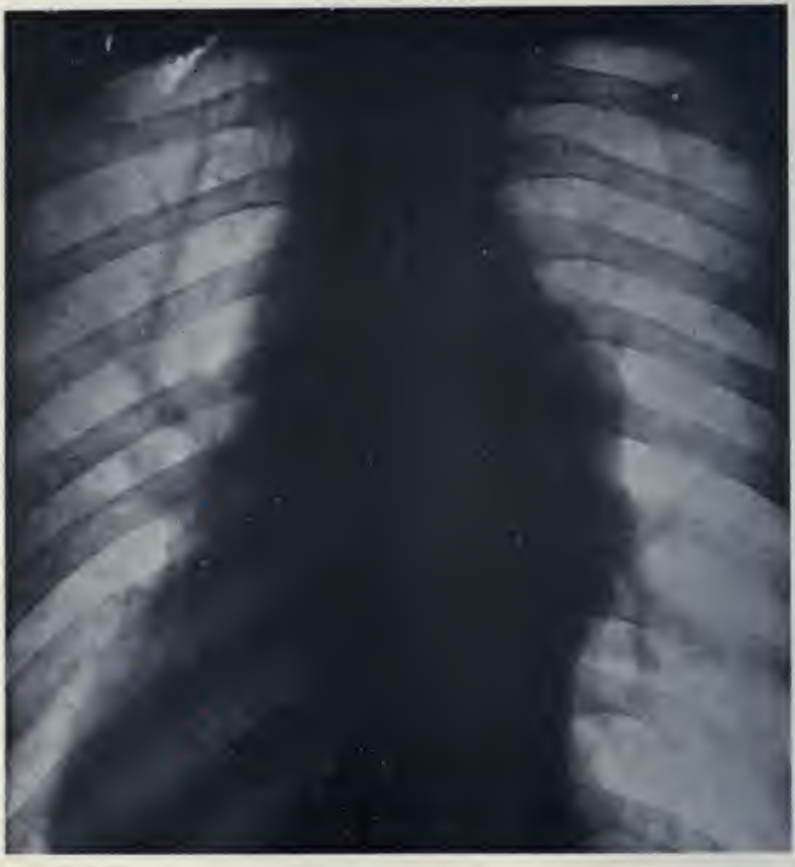

Fig. 430.—Roentgenogram showing shadow of large cold abscess above level of heart shadow along thoracic spine.

pressure over the sixth thoracic spinous process causes pain. The temperature shows an occasional rise to 99° F. The urinary findings are negative.

This is a case of Pott's disease with cold abscess which has tracked between the ribs and appeared several inches from the spine—a common site. The lack of typical signs of Pott's disease on superficial examination might lead to an error in diagnosis.

CLINIC OF DR. GATEWOOD

PRESBYTERIAN HOSPITAL

DISLOCATION OF THE OUTER END OF THE CLAVICLE

Summary: Diagnosis, pathology, and etiology of dislocation of outer end of clavicle; conservative treatment—the felt board splint and the Martin bandage; operative treatment—reconstruction of ligaments with catgut; result in present case.

I WANT to show you first this morning an Italian boy, twenty-three years of age. He has been working as a farm-hand. Four days ago, while riding to his work in the field, his horse stumbled and he was thrown over the animal's head. As nearly as he can remember, he lit upon his shoulder, and although the horse rolled over on him, he received no injury worth mentioning except that to his shoulder.

Physical examination is negative except for a rather marked myopia, some superficial abrasions about the knees and left hip, and the shoulder injury. As you can see, there is a stair-step deformity of the right shoulder (Fig. 431). While there is no great amount of swelling present, there is considerable discoloration about the shoulder, showing that there has been some hemorrhage into the subcutaneous tissues. The diagnosis is almost self-evident. Pressure on the outer end of the clavicle causes some pain, but only a few pounds is required to reduce the deformity, provided the patient will throw his shoulder upward and backward, the outer end of the clavicle slipping readily into place with a slight click. Now, as I remove the pressure you will observe what happens. The deformity has recurred, the outer end of the clavicle projecting upward and outward over the end of the acromion. About the only condition which might be mistaken for dislocation of the outer end of the clavicle is fracture of the tip of the bone. This is not common, and when present can usually be differentiated by measuring the clavicles, the point of mobility being nearer the sternum on the affected side. There is also more pain than with dislocation.

Dislocations of the clavicle are rather rare. Most of them occur at the outer or acromial end. The majority of them are due to a fall upon the shoulder, the violence being great enough to tear the acromioclavicular and coracoclavicular ligaments. Sudden contraction of the trapezius probably aids in pulling the outer end of the clavicle upward. In complete dislocations, as in this case, the conoid and trapezoid ligaments are also torn. Reduction is usually very readily accomplished, although sometimes it is impossible owing to the interposition of a portion of the torn capsule or a piece of ruptured trapezius muscle.

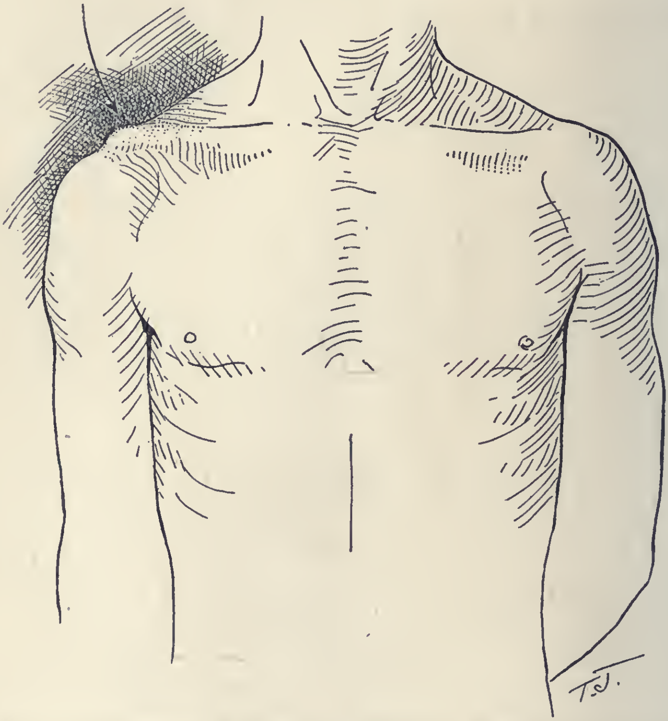

Fig. 431.—Characteristic deformity in dislocation of the outer end of the clavicle.

Maintenance of reduction is not such an easy matter, and a considerable proportion of the cases require operative interference. If the dislocation is not complete, there is usually no great loss of function and no operative interference is to be advised, even though the deformity becomes permanent. Where the dislocation is complete, if reduction is not possible or cannot be maintained, operative interference is usually demanded, either on account of the deformity or on account of the discomfort in motions of the shoulder.

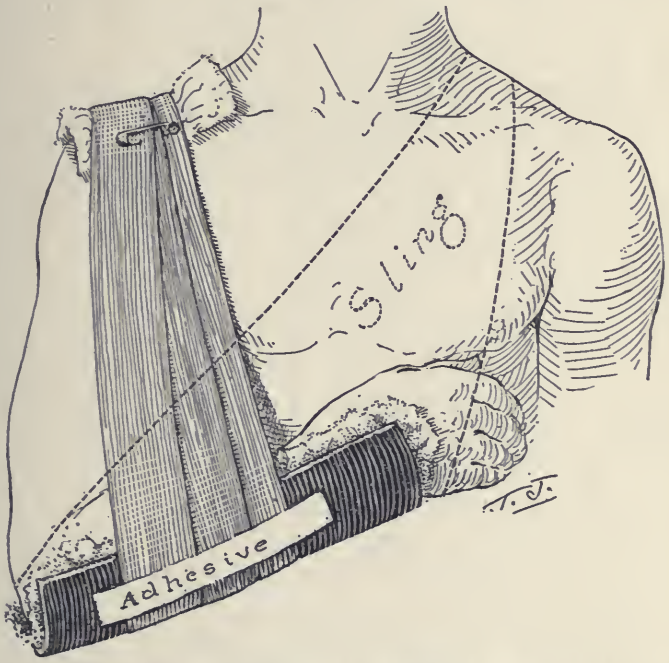

Fig. 432.—Dislocation reduced and immobilization attempted by means of the molded felt splint, Martin bandage, and sling, as recommended by Dr. A. D. Bevan.

When this patient first came to me I reduced the dislocation very easily and tried to maintain proper position without operative interference. Before coming here the usual method of treatment—that is, with the aid of an adhesive plaster band carried over the end of the clavicle and around the elbow—had been tried without success. I attempted to maintain reduction by the method described by Dr. Bevan some years ago (Fig. 432). A felt board splint was molded to fit the forearm including the hand. This was well padded with cotton. A good pad of sheet-wadding was placed over the dislocated end of the clavicle and several turns of a Martin bandage used to maintain reduction. This usually is all that is necessary where the dislocation can readily be reduced. However, in this particular case I have failed, largely owing to the rather sloping shoulder of this patient, which allows the pad to slip off of the clavicle.

The patient is now asleep. I am making an incision about 2 inches long parallel to the clavicle and well anterior to the dislocation, the reason for this being that I intend to use the same appliance after operation which I have employed before, and it is well to prevent pressure over the line of suture. The end of the clavicle is, as you see, readily exposed and the torn acromioclavicular ligament comes into view. In order to obtain a firm hold upon the outer end of the clavicle it is necessary to place a suture so that traction can be made from below in the direction of the coracoacromial ligament. I am now drilling two holes through the distal end of the clavicle and one obliquely through the acromion. With heavy chromicized catgut I am able to hold the clavicle in very good position. A second suture is put through the other hole in the clavicle and a good bite taken in the coracoacromial ligament. This gives considerable additional security (Fig. 433). The torn joint capsule is still to be sutured with some finer catgut. The skin and superficial fascia are now closed with interrupted subcutaneous catgut sutures and without drainage. I have used a heavy sterile pad for the dressing, holding it in position with two strips of adhesive. I shall now replace the molded felt splint to the forearm and re-apply the Martin bandage. This bandage should consist of good gum rubber and be about 3 inches wide. Part of my former trouble may have been due to the fact that I used a narrow Martin bandage. It is not necessary to make much pressure, as the sutures keep the bones in good position. After the bandage is in place it is fixed with some safety-pins, taking in the shoulder pad. I hope this will prevent the bandage from slipping off the shoulder. In order to further fix it I am fastening a strip of adhesive over the bandage and lapping it on to the felt splint. A comfortable sling is now applied. This dressing will be left on for about three weeks.

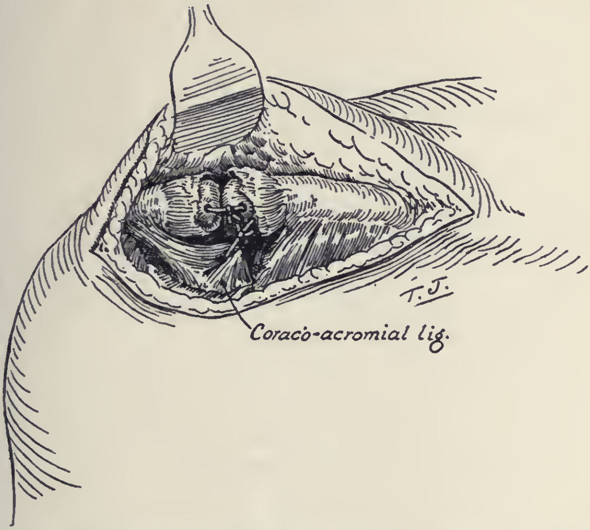

Fig. 433.—Method of fixing clavicle in position by suture to the acromion process and to the acromioclavicular ligament.

Keeping the patient on his back would remove the weight from the upper extremity and assist in proper healing, but I doubt if it is necessary in this case.

Postscript.—The patient made a complete and uneventful recovery and has resumed his former occupation.

ENCHONDROMA OF THE HAND

Summary: A patient presenting a swelling on outer border of right hand of lifelong duration; diagnosis; pathology and surgical anatomy of enchondromata; treatment.

This patient has been in the hospital a number of times. She has been treated for bronchial asthma and apparently has completely recovered. At any rate, her general health is greatly improved and she has gained in weight from 99 to 118 pounds. As long as she can remember she has had a swelling over the fifth metacarpal bone and the proximal phalanx of the little finger of the right hand. It has not greatly inconvenienced her until the last year or two. At present she complains of some pain in the ring and little fingers and considerable stiffness of the little finger. She also complains of the tumor mass which we can see (Fig. 434). This has gradually increased in size until it bothers her a good deal in closing her hand.

As she is thirty-three years old and has had the tumor for a number of years, there is little likelihood of its being malignant. You will notice that the proximal phalanx and the metacarpal bone are apparently involved in the pathologic process. The multiplicity of the lesions is at once suggestive of a cartilaginous tumor. Now let us examine the structure of the tumor radiologically (Figs. 435, 436). The *x*-ray shows that the middle phalanx is also involved. You will note that the cortex of the bone is unbroken. There is a thin shell of bone over each tumor. They all have a homogeneous structure with some denser striæ, and here and there is a small very dense area due to calcification. These tumors evidently take their origin near the ends of the bones. This is the typical picture of multiple enchondromata. They are almost never purely cartilage and show either some calcification or degeneration, although they can usually be very definitely differentiated from sarcomas or bone cysts by their homogeneous appearance in the roentgenogram. The fact that several bones are involved is a point of distinct diagnostic value.

The tumors are usually more or less cylindric swellings and frequently are seen before closure of the epiphyses. Some men have believed that rickets is a predisposing cause owing to the pathologic ossification of the epiphyses, but there is no history of rickets in most cases. Dr. Bruce Gill some time ago presented

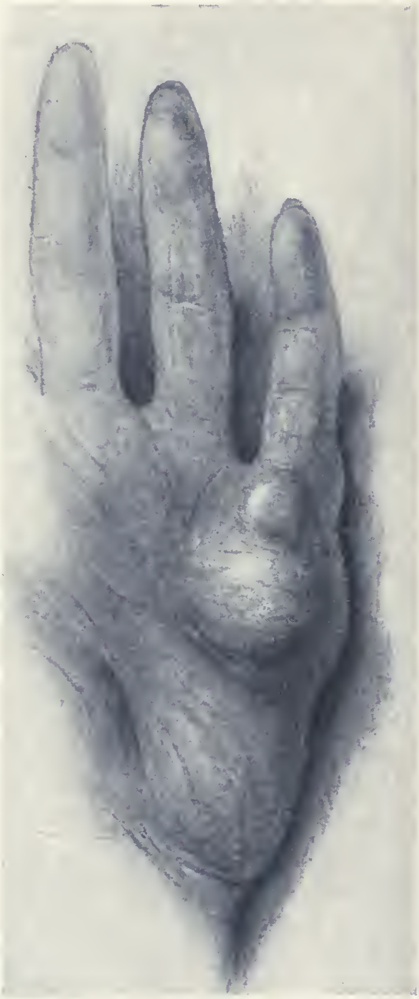

Fig. 434.—Multiple tumors (enchondromata) of hand.

a child, two and one-half years old, before the New York Surgical Society. In this case the x-ray showed that four metacarpals and nine phalanges of the right hand were involved. Some cases have been reported even younger than this, so that there is little question but that at least some of these tumors are congenital, and many pathologists insist that the condition is always a congenital one, due to an abnormal *anlage* in the intermediate cartilage of the bone involved. Virchow, Ziegler, and others feel that they spring from islands of cartilage left in ab-

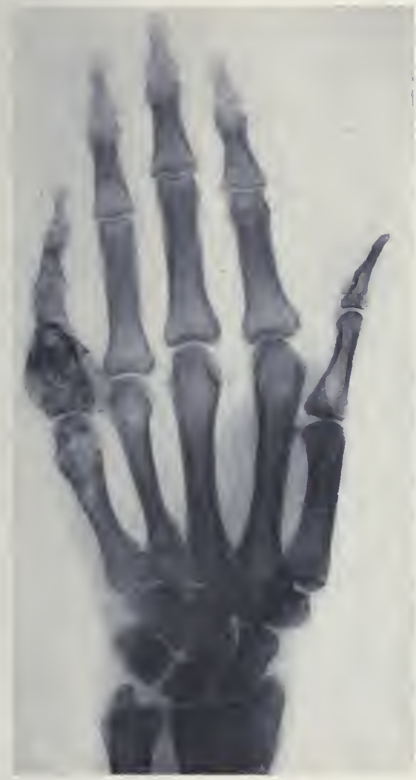

Fig. 435.—Anteroposterior and lateral views, roentgenographic, of lesion pictured in Fig. 434. Note multiple involvement of fifth metacarpal and all bones of the little finger.

Fig. 436.—For legend see Fig. 435.

normal situations, especially at the epiphyseal portion of the bone. There is frequently an hereditary history, although in the present case none could be obtained. Sometimes the first evidence of tumor formation is a pathologic fracture due to thinning of the cortex of the bone from pressure. I recently saw a Jewish boy, about twenty-three years old, with this same condition in the proximal phalanx of the little finger of his left hand. In defending himself from some robbers he fractured this digit. The *x*-ray, as you can see, showed a typical enchondroma (Fig. 437). He refused operation and was treated with a splint for about two weeks. Good bony union occurred. Most of the tumors are painless unless they attain considerable size and cause pressure.

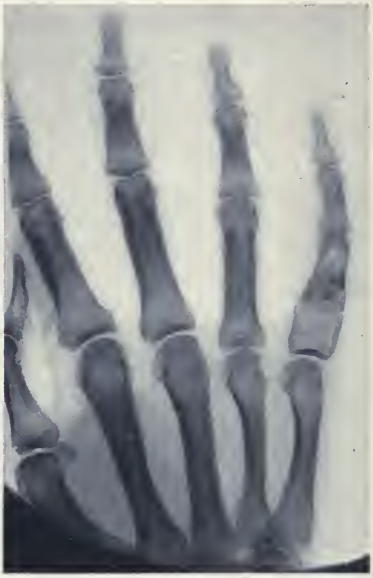

Fig. 437.—Fracture at site of enchondroma. Firm union occurred in this case without delay.

Cartilaginous tumors have been divided into enchondromata and ecchondromata. The usual distinction is based upon the occurrence of preformed cartilage, enchondromata being those tumors which are derived from pre-existing cartilage, while ecchondromata occur independent of any cartilaginous *anlage.* Ecchondromata not infrequently occur in the parotid gland, in the testicle, and as part of a teratoma. Adami's division, depending upon the location of the tumor within the shaft of the bone or beneath the periosteum, seems illogical to me and should be dropped.

I shall operate upon this case under a Martin constrictor, which gives me a bloodless field and greatly facilitates work. I am making an incision along the outer surface of the little finger, exposing the fifth metacarpal and the two proximal phalanges. The shell of the bone is very readily opened and a soft homogeneous cartilage-like mass found. There is some evidence of trabeculation. I am now carefully cureting the tumor mass from each of the bones. In doing this I have partially fractured the metacarpal near the distal end. This will not prevent healing and, indeed, may be beneficial in stimulating bone proliferation and thereby strengthening the framework of the diseased metacarpal. In some respects the tumor mass of the metacarpal resembles a cartilaginous exostosis, which is, as you know, a very closely allied condition. However, the shell of bone is intact and the center of the bone involved, so that there is little doubt that the tumor began in the epiphysis and has grown asymmetrically. The wound is now closed without drainage, a small posterior splint applied, and the constrictor removed.

A certain number of these tumors do recur, but this is not a reason for thinking them malignant. Occasionally they give metastases, but even then they are non-malignant unless they involve some vital structure. Certain of them undergo malignant degeneration, becoming chondrosarcomata, so that I think it is well to remove them by conservative measures, particularly if they are increasing in size. If the tumor is of sufficient size to cause permanent deformity of the finger, amputation might be considered, although this is rarely necessary.

Postoperative Note.—Microscopic sections show a typical cartilaginous tumor, so that there is no question about the diagnosis.

CLINIC OF DR. EDWARD LOUIS MOORHEAD

MERCY HOSPITAL

EXOPHTHALMIC GOITER: REMOVAL OF RIGHT LOBE AND ISTHMUS

Summary: Diagnosis of exophthalmic goiter; relative importance of the usual signs and symptoms; differentiation from goiters of other types; treatment—the hocky-stick incision; results in present case.

OUR first patient this morning, Miss M., gives us the following history: She is twenty years of age, a Bohemian, by occupation a seamstress. With the exception of some of the diseases of childhood, as measles, she has always enjoyed good health until her present complaint began. Father and mother are both living and well. There are two sisters and one brother, all living and well. There is nothing similar to her present sickness in the family that she knows of.

Menstruation began at fourteen years. Regular and not attended by any special discomfort. Appetite fair. Bowels constipated. She started to work in a tailor shop when fourteen years old, and has been employed in the same kind of work ever since.

Four years ago she first noticed a swelling in the right side of her neck. It was not painful and she did not pay much attention to it. The swelling gradually increased in size, and about two years ago she began to have a feeling of pressure in the region of the swelling, especially when she swallowed food.

At this time nervous symptoms began to develop. She became quite easily excited. Says her heart would beat very fast and that she would sweat a great deal, especially her hands. Headaches were frequent, and at the present time they are of daily occurrence. Of late she has been unable to attend to her work, and has spent a good part of her time in bed. She states that she has received treatment for her illness, but that it has not done her any apparent good.

Physical Examination.—Patient fairly well nourished; appears rather nervous. Head and neck: Eyes rather prominent; ears negative. The right side of the neck is more prominent than the left. This enlargement of the neck moves up and down with the larynx when the patient swallows, indicating that the enlargement is connected with the thyroid gland. The enlargement is of moderately firm consistence and apparently involves the right lobe and the isthmus of the thyroid gland.

Heart: Action rapid, 150; no murmurs; cardiac dulness not increased.

Lungs: Respiratory tones normal; no râles.

Abdomen: Negative.

There is marked tremor of the hands.

Urinalysis: Specific gravity, 1024; alkaline reaction; trace of albumin; occasional granular and hyaline casts; few white blood-cells and epithelial cells.

Blood: White count 7800; reds 4,750,000; hemoglobin 60 per cent.; coagulation time three and a half minutes.

The diagnosis in this case is quite evident, from the foregoing history and examination, to be exophthalmic goiter. One of the most important facts for the surgeon to bear in mind is that other forms of thyroid enlargement, whether cystic or solid, may be associated on the one hand with exophthalmic goiter, or on the other hand with hypothyroidism, and in undertaking operations for enlargements of the thyroid the surgeon should always bear this in mind, since in the case of hypothyroidism, while there may be an indication for the removal of a cyst or other tumor of the thyroid, the removal of what remains of an already imperfectly functionating gland may be attended by disastrous results.

The cardinal symptoms of exophthalmic goiter are: Enlargement of the thyroid, exophthalmos, tachycardia, and tremor. Other symptoms, less striking and characteristic, such as emaciation, muscular weakness, excitability and disturbances of the digestive organs and vasomotor system are frequently present. The order of development and the grouping of the symptoms are exceedingly variable.

In a well-marked case all the cardinal symptoms may be present and the diagnosis made quite easy. It is to be borne in mind, however, that even in marked cases anyone of these signs may be absent, and in early cases none of them may be marked. There are, then, cases presenting all possible gradations and combinations of symptoms, from the well-marked case with exophthalmos, goiter, tachycardia, tremor, and emaciation, to the case presenting few symptoms, such as tachycardia, emaciation, and muscular weakness, and no suggestion of enlargement of the thyroid or exophthalmus.

The disease is much more frequent in women than in men. The patients are often neurotic or hysteric individuals. Anemia, hemorrhage, and other depressing conditions appear sometimes to act as predisposing causes, as do profound emotional disturbances.

The enlargement of the thyroid may be marked or moderate, and is usually symmetric. Its consistence is soft or of medium firmness. Exophthalmus may be marked, moderate, or, rarely, absent. There is an increase in the size of the space between the lids; when the patient is directed to look downward, the upper lid in its motion lags behind the eyeball. There is absence of the power to converge the axes of the two eyes.

The heart's action is rapid—120 to 160 beats a minute. Palpitation occurs from slight mental or physical disturbances. Muscular tremor is not unlike that of chronic alcoholism, most marked in the hands, but also involving the muscles of the trunk; choreic movements may be present. Hysteric attacks are common, as are nervous irritability and other symptoms of neurasthenia. Increased secretion of the sweat glands, vasomotor disturbances, flushing, and edema occur. Other varieties of goiter, cysts and tumors of the thyroid gland, may be associated with the symptoms of exophthalmic goiter.

Differential Diagnosis of Goiter.—The mere enlargement of a normally placed thyroid gland, whether diffuse or circumscribed, is easily recognized. The anatomic situation of the tumor and the fact that it moves up and down with the larynx during the act of swallowing is enough to connect it with the thyroid gland. If the enlargement of the thyroid is associated with exophthalmus the diagnosis of exophthalmic goiter needs only a brief inquiry into the subjective symptoms and history of the case to make it certain. Note the size and situation of the tumor, whether it involves one or both lobes of the thyroid or the isthmus.

Pressure on the veins is indicated by cyanosis or congestion of the face and dilated subcutaneous veins. Paralysis of the sympathetic is indicated by a contracted pupil, partial ptosis, and flushing of the affected side of the face. Irritation causes a dilated pupil, sometimes exophthalmus and paleness of the skin. Upon palpation the mobility of the tumor is determined; unless the thyroid is very large or is wedged into the superior aperature of the thorax, or is one of the rare congenital forms which surrounds the trachea, it is usually quite movable. Immobility suggests malignancy. Adhesion of the skin to the tumor indicates malignancy or inflammation. The consistency of the tumor, the presence of cysts or hard fibrous nodules, is detected by palpation with both hands. The position of the larynx and trachea, whether displaced, bent, or compressed, may be determined more accurately by the same procedure. By auscultation, whistling or harsh breathing may be heard, indicating compression of the trachea or involvement of the nerves of the larynx. In some very vascular goiters a soft systolic murmur may be present over the tumor.

Laryngoscopic examination: If one or both recurrent laryngeal nerves are pressed upon or unduly stretched by the tumor the laryngoscopic picture may show one or both vocal cords paralyzed so that they cannot be adducted. In some cases displacement or narrowing of the trachea may be recognizable through laryngoscopic examination. Simple hyperemia of the thyroid occurs for the most part in young women and girls, and is associated with puberty, menstruation, or pregnancy. The gland is moderately enlarged and of normal consistency. In some cases this condition precedes permanent follicular hypertrophy, in which the entire gland is markedly increased in size and of firm consistence. Colloid goiter of the diffuse type occurs for the most part in women during middle life. The tumor is of slow growth and the two halves of the gland are enlarged unequally. Where the hypertrophy affects the blood-vessels, the gland may pulsate distinctly on palpation.

Fibrous goiter is rather rare. It occurs mostly in patients of advanced years. It is characterized by the formation of dense, hard fibrous nodules disseminated through the gland. The nodules are usually movable one on the other.

Cystic Thyroid.—Cysts may form in a gland otherwise apparently normal, or in combination with diffuse hypertrophy of the parenchymatous or fibrous variety. The cysts vary in size and may be single or multiple.

Malignant tumors of the thyroid, both sarcoma and carcinoma, occur with moderate frequency, occasionally in thyroids already the seat of benign enlargements.

Many theories have been advanced as to the cause of the production of the group of symptoms which we call exophthalmic goiter, but there seems to be a pall of confusion spread over the whole question of the origin of the disease. The interpretation of the disease upon which its surgical treatment has been based for years is that the symptoms which comprise the disease are produced exclusively by overactivity of the thyroid gland with increased production and absorption of its secretion.

Treatment.—In the medical treatment of exophthalmic goiter many drugs and various methods have been used, results being claimed for many of them. Rest, absolute, both physical and mental, with proper diet and such medication as may be required, is perhaps a good procedure to follow for a certain time, at least until there is subsidence of the acute symptoms. Some of these patients have intervals when their symptoms apparently subside. In such intervals surgical measures may be considered.

The operative procedures for exophthalmic goiter which are in general use are ligation of the vessels and partial thyroidectomy. Ligation is usually followed by subsidence of the symptoms and general improvement in the patient's condition, but as a curative measure the procedure is less reliable and less effective than partial thyroidectomy.

Partial thyroidectomy is undoubtedly the most efficient treatment that we know of at the present time. The amount to remove is an important feature. We must leave enough of the gland to supply physiologic requirements, and yet not enough to allow the continuance of a pathologic surplus. It is said that from one-sixth to one-fourth of the gland, that is, about one-half of a lobe, is sufficient to supply the necessities of the body, provided the part left is capable of functionating in a normal manner. Usually one lobe and the isthmus are removed. This gives a fair guarantee of complete and rapid cure of the hyperthyroidism and keeps within the limit of safety. If necessary, at some future time, the second lobe could be resected, regarding such a procedure as a step in the graduated operative treatment of the disease. It is well to have it understood before operation that more than one operation may be required. In certain cases of large bilateral goiter excision of one lobe and resection of the other is justifiable at one operation.

Operation.—We shall proceed to do a partial thyroidectomy on the patient now before you. She has received the usual preliminary preparation for operation. The head of the table is slightly elevated and a sand-bag is placed beneath the shoulders, thus allowing the head to fall backward. This extends the neck and renders the operative field prominent. A sterile apron is placed over the hoop attached to the upper part of the table, thus excluding the patient's head and the anesthetic from the field of operation. Various incisions are used for the exposure of the thyroid: the transverse or collar incision; the **U** incision; the hockey-stick incision, which is made by omitting the upward prolongation of one side of the **U** incision, and the oblique incision, which follows the anterior margin of the sternomastoid. In any surgical procedure on the thyroid it is essential that a liberal exposure be made, so that all steps of the operation may be performed in an open field.

The incision in this case will be of the hockey-stick form. Beginning low down as a collar incision, it is carried upward on the right side (Fig. 438, 1). This incision is through the skin and platysma and superficial cervical fascia which are now dissected upward and to the left. The anterior jugular veins are clamped and ligated. This flap is freed by blunt dissection to the upper part of the thyroid cartilage, if necessary, and held to one side by a sharp retractor. The depressors of the thyroid are now exposed and are separated vertically by passing scissors between the sternohyoid muscles. At this stage of the operation it is sometimes necessary to cut across and reflect the sternohyoid, sternothyroid, and omohyoid on the side to be removed. This gives a more open field for operation, but I prefer to avoid cutting the muscles when it can be avoided, and in this case they will be separated and held apart with retractors, as I believe a sufficent exposure can be made in this manner. The right lobe with the large veins of the capsule is now exposed. Two important steps must now be taken, namely, the ligation of the superior thyroid vessels and the incision of the surgical capsule, to allow the intracapsular removal of the gland. In some cases the superior pole is grasped with the fingers and lifted forward and the superior thyroid vessels clamped and ligated. In this case the capsule will be opened first. A vertical incision is made in the capsule (Fig. 438, 2). This incision is enlarged with blunt-pointed scissors downward as far as necessary and upward to the anterior aspect of the pole. The capsule is retracted with Allis forceps. The superior thyroid vessels are freed, clamped, and ligated. The upper pole is now dislocated and drawn forward and mesially. The tissues are bluntly dissected off the posterior surface of the lobe by using gauze over the fingers. The dissection is carried down until the inferior thyroid vessels are encountered. These vessels are now clamped and ligated (Fig. 438, 3). The dissection should be carried as close as possible to the true capsule of the gland, and great care must be exercised to avoid injury to the parathyroids.

The lobe extends downward behind the sternum and is much larger than it appeared to be previous to operation. The lobe is now free, no injury having been done to the parathyroids or the recurrent laryngeal nerve. The isthmus is now freed from

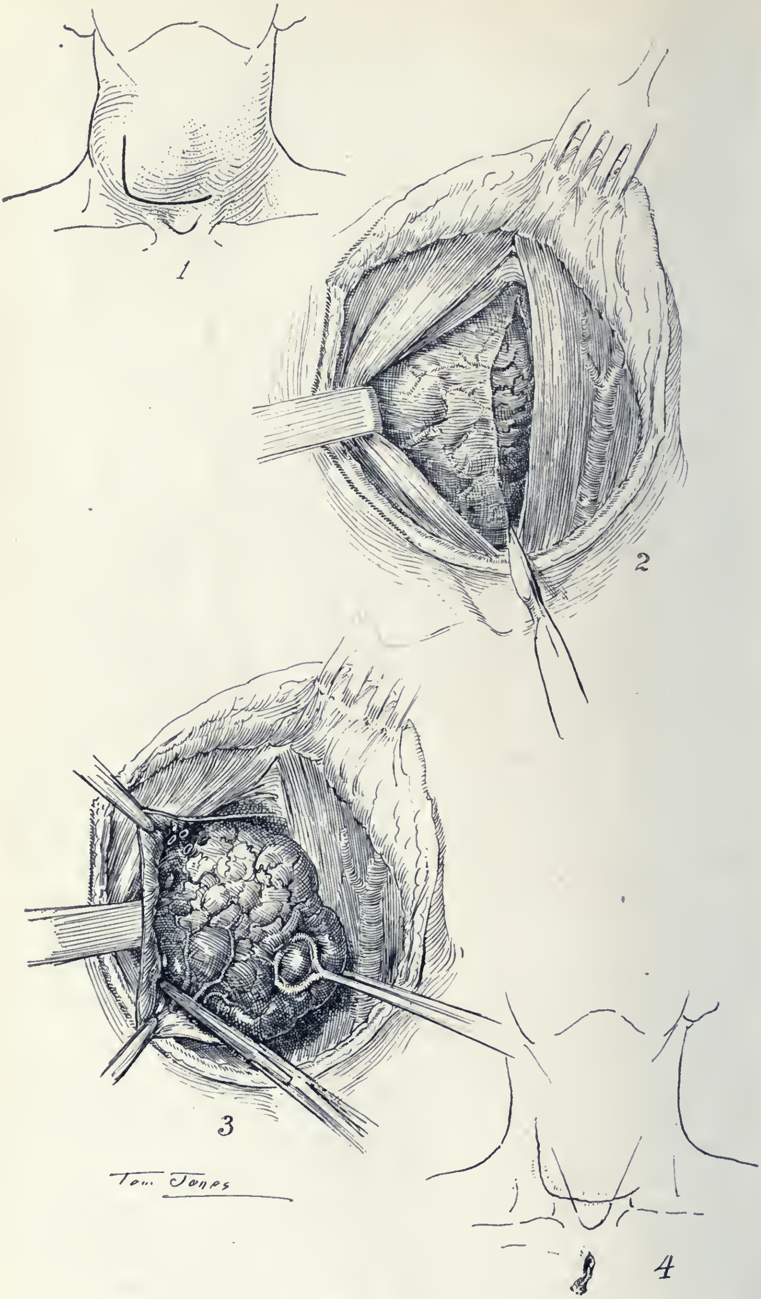

Fig. 438.

the trachea, clamped close to the other lobe, and a continuous overhand catgut suture applied. The suture is drawn taut and tied as the clamp is withdrawn. All hemorrhage from any point must be completely stopped.

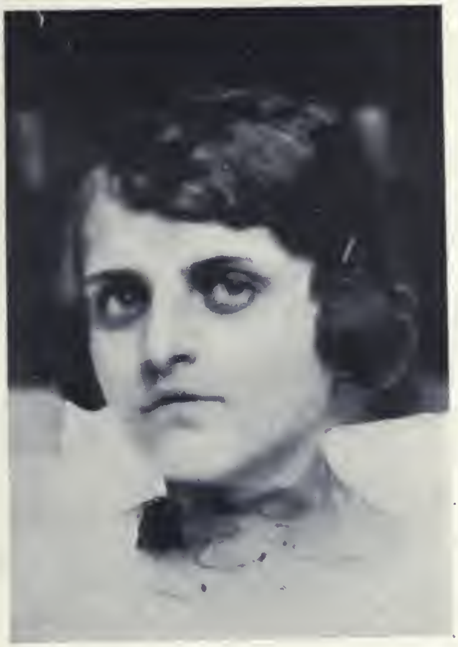

Fig. 439.—Note linear scar. Exophthalmos not as marked as previous to operation. Photograph taken two weeks after operation.

A small counteropening for drainage is now made in the midline below the incision and a small gutta-percha drain inserted. The edges of the surgical capsule are brought together and sutured. The muscles come back to their normal position, since they were not cut across. The fascia and platysma closure

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Fig. 438.—1, The hockey-stick incision. 2, Strap muscles of neck retracted, right lobe of thyroid exposed, and capsule incised preparatory to shelling out the gland. 3, Gland partially delivered. The superior thyroid vessels have been ligated; the inferior thyroid vessels are shown in the grasp of a clamp. 4, Operation completed; incision closed by subcuticular stitch and drainage provided through incision lower down in midline.

is made with interrupted sutures, and the skin is closed with a subcuticular suture of fine chromic catgut and a dry dressing applied.

In the closure of the skin incision a subcuticular suture will do away with the production of an unsightly scar. It is not necessary to cause a bad scar if you make a nice clean incision and a careful dissection; in all operations upon the face or neck one should bear in mind the future appearance of the patient.

In the after-treatment of these patients we have them raised upon a back-rest as soon as they are out of the anesthetic and give them an abundance of fluids to drink. This position is much better for the patient and they seem to like it in preference to having the head at a lower level than the body, as advised by some. This patient will be allowed to be up in about one week. The drain will be removed at the end of forty-eight hours.

Following operation, the exophthalmic patient should have plenty of rest, good food, and such internal medication as the individual case demands.

Note.—Patient made an uneventful recovery. Pulse came down to 80. Nervousness has practically disappeared, and flushing and excessive sweating have stopped. She was allowed to be up out of bed on the tenth day (Fig. 439).

FRACTURE OF THE FEMUR IN A BOY FIVE YEARS OF AGE: OPEN TREATMENT FOLLOWING FAILURE OF NON-OPERATIVE METHODS

This little boy, K. C., is five years old, and he is shown to you so that you may see the end-results of the treatment of a fracture of the middle third of the shaft of the femur by the open method of plating.

Seven weeks ago he was injured. He was struck by an automobile, the wheel passing over his left thigh. He was immediately transferred to the hospital, where I saw him about two hours after he received the injury. Upon examination at that time the limb lay powerless, visibly shortened, rotated outward, and with the knee flexed. There was abnormal mobility, determined by placing the hand beneath the limb opposite the supposed point of fracture and attempting to lift it. At the same time crepitus could be felt and heard. The loss of continuity could also be established by gently lifting the leg, when the mobility and angular deformity were readily apparent. Rotary movements of the leg also served to establish the presence of fracture by noting that the trochanter did not follow the movement of the lower fragment. The thigh was swollen, contused, ecchymotic, and extremely painful. The signs and symptoms of fracture of the shaft of the femur were so evident that it was not necessary to resort to any very extensive examination or manipulations. The boy was placed in bed, a blanket splint and cold applications applied. Two *x*-ray plates were made of the injured limb, an anteroposterior and a lateral view. These plates show very clearly the nature of the injury—a fracture of the middle third of the shaft of the femur. The lower fragment is drawn upward, inward, and backward, producing an angular deformity (Fig. 440). There is also outward rotation of the lower portion of the limb. The upper fragment, being acted upon by the iliopsoas and by the glutei, is flexed, abducted, and rotated outward. Two attempts (under anesthesia) were made to reduce the fracture by traction. An *x*-ray taken following each attempt, with traction apparatus in action, showed that both attempts were failures. Traction by weight and pulley was tried for one week and, having failed, operation was decided upon.

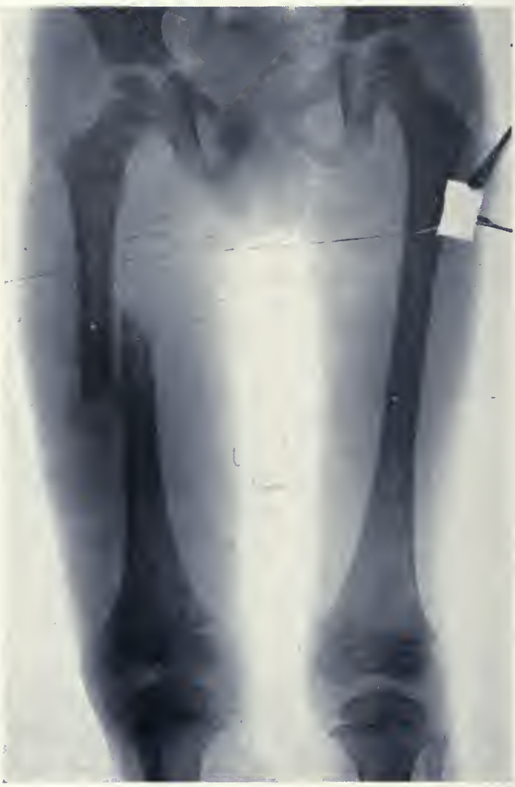

Fig. 440.—Anteroposterior view, showing the inward and upward displacement of lower fragment and the abduction of the upper fragment of the fractured femur. Note the degree of swelling in the injured limb. The shadow of a displaced fragment of bone appears at the lower end of the upper fragment. Plate made a few hours after injury was received.

An open operation was performed, and it was quite evident why the attempts at reduction had been failures. The first *x*-ray plate (Fig. 440) showed a detached fragment of bone lying between the two portions of the shaft. At operation the upper end of the lower fragment was found to be badly comminuted and entangled in the muscles and fascia. The detached fragment of bone was removed, reduction accomplished, and a Lane plate with four screws applied.

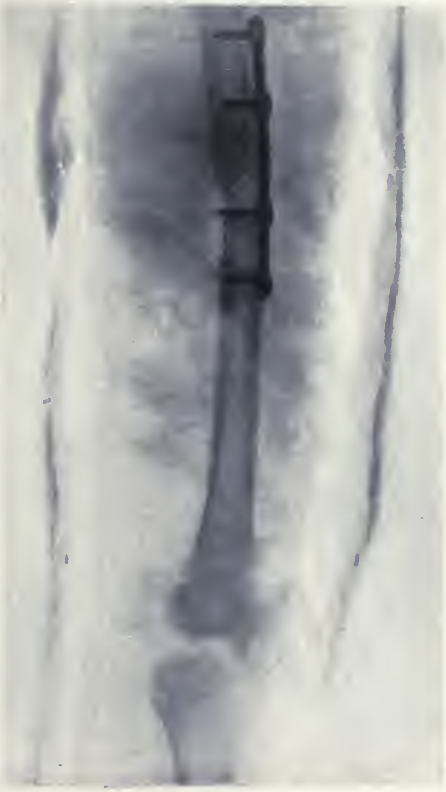

Fig. 441.—Fracture reduced and maintained in reduction by Lane plate and plaster-of-Paris cast.

The *x*-ray plate made immediately following operation shows that the ends of the fracture are in practically perfect apposition (Fig. 441). A plaster-of-Paris cast, encasing the entire limb from the heel up to and including the abdomen, was applied.

The patient had no pain or elevation of temperature following the operation. This cast was allowed to remain in place for four weeks, there being no indication for its removal or disturbance. At the expiration of four weeks the patient was anesthetized, the cast removed, the wound reopened, and the plate removed. The bone was apparently firmly united and in good position. There was no pain, elevation of temperature, or any disturbance following this operation. The sutures were removed on the tenth day.

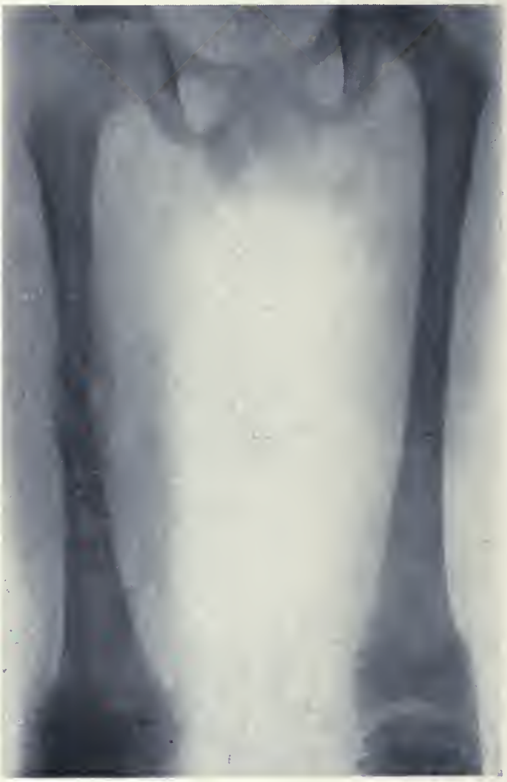

Fig. 442.—*x*-Ray plate made six weeks after operation. Note that the fragments are in line; there is no shortening and there is a firm callus.

Two weeks following the removal of the Lane plate another *x*-ray plate was made. This plate shows the shaft of the femur in practically perfect line, good bony union, with a firm callus surrounding the site of fracture (Fig. 442).

At this time there is a fair degree of motion in the knee-joint and, with massage, complete motion will soon be restored. In about two weeks he will be allowed to be up on crutches and gradually allowed to put a little weight on the limb.

Fractures of the femur in children of this age are exceedingly difficult to treat, no matter what form of splint is used or by what method the traction is applied. Operation should not, as a rule, be done, and is indicated only in complicated fractures, especially spiral fractures with comminution; in oblique and transverse fractures which are not reduced after one week's traction; in fractures in which the muscle is penetrated; in injuries to the vessels; in compound fractures; and in all cases in which satisfactory apposition of the fragments is not obtained and maintained by bloodless methods.

CLINIC OF DR. G. L. McWHORTER

PRESBYTERIAN HOSPITAL

ACUTE OBSTRUCTIVE APPENDICITIS

Summary: A patient presenting an unusual combination of symptoms—local abdominal tenderness without muscle spasm associated with history suggestive of appendicitis and a rising leukocyte count; diagnosis; pathology of obstructive appendicitis.

THIS patient, Dr. V. B., an intern in the hospital, was taken sick Friday afternoon, June 13, 1919. He had eaten a light dinner at 1 P. M. He lay down to rest for a few hours, feeling well, and awakened about 4 P. M. with a diffuse, indefinite pain over the abdomen. This was not constant, but came on at intervals and was not severe. He visited his home and while there ate a light supper at 6 P. M. The pain remained diffuse over the abdomen, but was not severe enough to alarm the patient. He returned to the hospital at 7 P. M. and a half-hour later noticed an area of localized superficial tenderness in the right lower quadrant. A white blood count was made showing 12,000 white blood-cells.

About 8 P. M. the patient became nauseated, but did not vomit. This was associated with a desire to go to stool, but he got no result. The abdominal pain now became more severe, becoming localized over the right lower quadrant. This was not constant, but came on at intervals of five to fifteen minutes, and lasted only a minute or so. The temperature was 97.6° F. at 9 P. M.

At 10 P. M. a second white blood count showed 18,000 cells. A differential count was made and the cells were found to be 70 per cent. polymorphonuclears, 4 per cent. lymphocytes, 8 per cent. large lymphocytes, 12 per cent. large mononuclears, 2 per cent. transitionals, and 4 per cent. eosinophils.

The urine was negative.

About 10.30 P. M. the pain became more severe and colicky in character. It increased in intensity and the paroxysms became more frequent. These came on every five to ten minutes and were severe enough to cause the patient to double up. They gradually became more severe and frequent until at about 11.30 P. M. they were almost continuous. There was considerable rumbling and gurgling in the colon.

Past history: The patient had had an acute attack of jaundice in 1915. One rather interesting incident about eight months before, occurred in the evening, the patient became suddenly nauseated and vomited his supper. He had vague distress in the abdomen. The next morning he felt perfectly well.

Two days ago the patient took 1 ounce of magnesium sulphate. He did this because he had an infected hair-follicle on his chin. He had been having a good bowel movement every day. Otherwise, the history was negative.

Physical examination, made by me about 11 P. M.: Appearance, slightly pale. Chest and general examination, except the abdomen, negative.

The abdomen was examined carefully. Inspection, negative. On palpation of the left side first, there was nothing abnormal felt. The right side was palpated, gently at first, and no increased muscular resistance or rigidity could be determined as compared to the left side. The whole abdomen was relaxed. However, upon pressure over McBurney's point acute tenderness was complained of. The tenderness was definitely localized to this point and was not associated with muscle spasm, at least no spasm could be detected.

During the paroxysms the whole abdomen became hard, and although the pains began in the right lower quadrant, they passed over to the left side.

Since localized muscle spasm and rigidity are very important diagnostic symptoms of appendicitis, their absence in this case made me cautious in diagnosing appendicitis without more evidence than the subjective symptom of acute tenderness on pressure and the history.

The rectal examination revealed no evidence of fecal impaction, a pelvic abscess or a tumor, and the prostate and seminal vesicles were negative, but the sphincter was slightly relaxed.

Frequently in acute appendicitis or in pelvic inflammations or abscess I have noted this peculiar relaxation of the sphincter. The patient, at the same time, may be hypersensitive to digital examination.

Following the rectal examination the patient had a copious bowel movement, but this gave no relief from the frequent and severe paroxysmal pains.

In the diagnosis of appendicitis we must always consider the evidence for and against it, and then carefully rule out every other possibility whether it be surgical or not. From the history we find that there were no similar previous attacks. This attack came on with nausea and with general abdominal discomfort. Later the pain localized in the right lower quadrant.

The general development of the pain over a period of several hours instead of coming on suddenly is like appendicitis and different from perforated gastric or duodenal ulcer or acute pancreatitis. There was no history of any gastric disturbance suggestive of an ulcer. The colicky character and severity of the pain suggested an acute visceral colic or obstruction. Its location was over the base of the appendix, and a ureteral stone had to be definitely ruled out.

The urine was negative. No red cells were found after careful search. Finding red cells would not necessarily have been against appendicitis, as they are not infrequently present in acute appendicitis, but their absence is very uncommon with ureteral stone producing such severe symptoms.

There was no radiation of the pain to the groin, the testicle, or to the end of the penis. The pain was not high up over the kidney region. With hydronephrosis or Dietl's crisis with pain in the right lower quadrant we would expect to find a low lying kidney. The kidney was in normal position and no pain was present on palpation. There was no tenderness over the region of the gall-bladder, no jaundice, or pains radiating to the right scapula.

The most difficult thing to rule out was bowel colic due to fecal stasis or to food poisoning. While there were one or two hard, small particles of fecal material felt in the rectum, yet the patient had been having good daily movements and there was no mass palpable anywhere in the large bowel. He had eaten nothing unusual and the colicky pains all started over the region of the appendix and then passed to the left side.

Following the large bowel movement there was no relief from the pains and the tenderness. These findings on examination pointed to the appendix as the source of the colicky pains and local tenderness. The temperature and pulse remained normal throughout the evening, but the blood count gave us evidence of increasing inflammation.

The white blood-cells numbered 12,000 at 7.30 P. M. and at 10 P. M. had increased to 18,000 with 70 per cent of polymorphonuclears. This is definite evidence, and with the other symptoms and our ability to rule out other sources of inflammation, it locates the disease as probably in the appendix.

I advised immediate operation, and operated at about 12 o'clock midnight.

Operation: General anesthesia. Right rectus incision. The abdomen was explored, the gall-bladder and ducts were found negative. A firm long mass was then felt in the right iliac fossa. This was found to be an acutely inflamed appendix. It was distended to about three times its normal size, almost to the bursting point, with a clear serous fluid. There was a hard mass the size of a kidney bean impacted in the lumen at the base of the appendix. The tissues appeared normal proximal to the obstruction. I removed the appendix just proximal to the obstruction, invaginated the stump with mattress sutures, and closed the abdomen.

This hard mass remained impacted in the lumen even after cutting off the appendix close to it, and resisted manipulation and the pressure of the fluid in the distal part. On cutting into the distended appendix a clear serous fluid spurted up about 3 inches. The obstruction was found to be due to a long, oval, hard fecolith which was tightly impacted in the somewhat narrow lumen at the base. The appendix was unusually long and the lumen was of good size. There were several small particles of fecal matter in this distended part. The mucosa had sloughed from the wall around the fecolith, showing an irregular margin at its junction with the mucosa beyond this region (Fig. 443). On microscopic examination of the wall around the fecolith the mucosa was found to be absent, the surface was necrotic, congested blood-vessels, edema, interstitial hemorrhages, and a dense infiltration of mononuclear cells were present throughout the wall. A section of the wall near the tip showed begin-

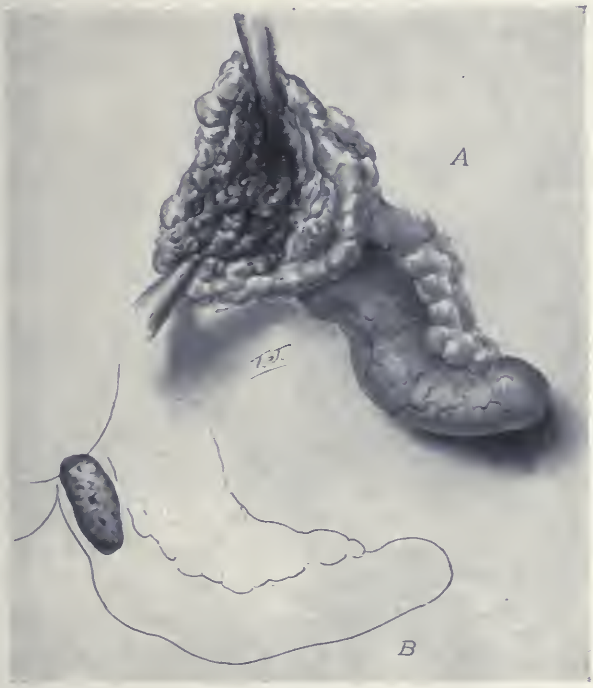

Fig. 443.—*A*, The appendix has been split open in the proximal third. The mucosa is entirely gone in that part of the wall which surrounded the stone. There is an irregular sloughing margin of mucosa at the location of the distal end of the fecolith. *B*, Diagram indicating the location of the fecolith at the base of the appendix. The appendix was markedly distended with clear serous fluid.

ning mucosal disintegration and a similar type of mononuclear cellular infiltration. Only occasional polymorphonuclear cells were seen. The patient, as you see, has made an excellent recovery.

When appendicitis has typical symptoms it is comparatively easy for one to diagnose the lesion. However, in some cases there may be symptoms confusing disease of the appendix with disease of any other abdominal organ, or symptoms may be produced reflexly similar to appendicitis, especially by pneumonia, or by a general intoxication, or by disease of the central nervous system, as in tabes dorsalis.

It is not particularly unusual for severe inflammation of the appendix, even with gangrene, to take place with very little disturbance and to be proved at operation in a patient who has perhaps walked into the hospital.

One must always suspect subjective symptoms as perhaps being in a hypochondriac who knows the typical symptoms of appendicitis. We should always try to explain any atypical symptoms by a variation in the pathology or position of the appendix and always be cautious in operating, even with typical symptoms, in order that we may find the expected pathology.

We have a wide variation in the symptoms dependent upon the types of appendicitis and its location.

Deaver recently stated that fortunately nowadays we hear little of appendicular colic, and he is skeptical that obstruction occurs independently of inflammation. He says that if obstruction is the primary feature, inflammation soon follows, and it is a mistake to differentiate inflammation from obstruction, as the indications are the same.

The mistake, it seems to me, is in the failure to differentiate clinically acute obstruction of the appendix and so failure to recognize the condition as appendicitis, because of the difference in symptoms.

Wilkie differentiates very sharply between acute appendicitis and acute appendicular obstruction. He describes the onset as sudden, with vomiting, severe pain which may be intermittent or constant, and states that there is always tenderness over the appendix, that the rigidity may be well marked or slight, and that there is no early disturbance of the pulse or temperature.

As causes of acute obstruction he gives fibrous stenosis with plugging or acute kinking of the appendix. Concretions are driven into the narrowed part by enhanced peristalsis of the appendix, which shares the increased peristalsis of the intestine. He found experimentally that, when fecal matter was present in the obstructed lumen of the appendix, gangrene might occur in sixteen hours without interference with the blood-supply.

Heile found that when the obstructed lumen is free from fecal matter chronic empyema or hydrops may result, or the lesion may simply heal. He believed that the degree and rapidity of morbid changes in obstruction were in direct proportion to the amount of fecal matter present. He found undigested protein and an alkaline reaction favored autolysis of the lymphoid tissue. The changes were distention, leukocytic infiltration, necrosis, and gangrene, first of the lymphoid tissue and finally of the wall.

Concerning the etiology of appendicitis, there are two chief theories: one is that the cause is enterogenous, beginning from the lumen, the other is that it is hematogenous or lymphogenous.

Perhaps the earlier generally accepted idea was that appendicitis was enterogenous in origin, as evidenced by Aschoff. He believed that inflammation occurred from fecoliths, soft feces, or by extension from colitis, and that inflammation of the appendix lymph-follicles occurred by direct infection through their lacunæ or crypts.

Sudsuk found 57 per cent. of examined appendices contained particles of feces (Oberndorfer).

Aschoff likened the changes to those in tonsillitis, either with abscess formation in the wall or with pseudomembranous changes similar to those in diphtheria.

Adrian injected organisms into the blood and found the appendix regularly involved. This predilection was due, he thought, to the lymph tissue, but at necropsy lesions of other organs containing lymph tissue were not so constant. He believed appendicitis was only an expression of a general infection.

Kretz endeavored to demonstrate the localization of organisms in the follicular tissue of the appendix from the blood-stream, coming especially from the tonsils. He reports fatal cases of angina and appendicitis, where he isolated streptococci from the tonsils, intestinal wall, peritoneal pus, and at times from the glands of the neck.

Rosenow believes that there is a selective localization of the organisms which obtain access to the blood-stream, and that this is dependent partly, at least, upon a certain grade of virulence or some transient biologic characteristic which favors certain organs.

Bacteria may also acquire new properties and new affinities in some focus, as the tonsils. Thus duodenal or gastric ulcers or other secondary foci may result. These secondary foci may themselves be the sources of general infections of varying types.

Various epidemics of appendicitis have been reported. Recently one was reported of parotitis and appendicitis (Rosenow and Dunlap). The seasonal prevalence of acute appendicitis is known, and its occurrence in several members of the same family has been noted repeatedly.

If appendicitis is a local manifestation of a general infection due to a special organism it should be possible to obtain the organism in the blood at some time during the disease. Attempts to obtain the organism in a large series of cases have failed. This is the one main objection to the theory of hematogenous origin of appendicitis. It is believed that organisms may pass from a focus in the upper respiratory tract along the intestinal tract, or that the organisms which are already present in the colon and appendix may increase their virulence, or that trauma, fecal concretions, or lowered resistance will favor the development of inflammation.

It is well established that gradual obliteration of the appendix takes place. Ribbert found obliteration of the lumen of the appendix rare in children, but common in old age.

The following table by Ribbert illustrates the frequency (Oberndorfer):

Years	Complete Obliteration of Appendix in—
One to ten	4 per cent.
Ten to twenty	11 per cent.
Twenty to thirty	17 per cent.
Thirty to forty	25 per cent.
Forty to fifty	27 per cent.
Fifty to sixty	36 per cent.
Sixty to seventy	53 per cent.
Seventy to eighty	58 per cent.

This gradual obliterative change may give irritative symptoms and may cause chronic inflammation, but this does not necessarily predispose to acute inflammation. However, narrowing of the lumen with stenosis of the base may cause impaction of a fecalith or stasis may occur. Reflex gastric symptoms may occur (McWhorter). Some authors think that stasis favors the increase in virulence of organisms in the appendix (Adrian).

Merklen believed that the virulence of the colon bacillus was increased through the influenza bacillus (Kummel). Most authors at present think that infection is prerequisite for the production of appendicitis. Occasionally we see cases like this one where apparently there is a primary complete obstruction at the base of the appendix, with a close resemblance to a strangulated or completely obstructed loop of intestine.

Early operation here is just as important as in acute obstruction of the intestine and in strangulated hernia. Delay in this type of appendicitis is very dangerous.

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CLINIC OF DR. THOMAS J. WATKINS

ST. LUKE'S HOSPITAL

HIGH RECTOCELE

Summary: Presentation of case and detailed description of operative treatment.

By high rectocele is meant one that occurs above the upper border of the levator ani muscle and which cannot be relieved by the ordinary perineorrhaphy. The ordinary perineorrhaphy deals entirely with the levator ani muscle and its fasciæ and can have little or no beneficial effect upon a rectocele coming down from higher up. They are extremely difficult to cure and they generally occur in patients who have an enteroptosis of all the abdominal organs. This patient is a typical case of the kind.

She was referred to me by Dr. J. S. Hunt. Age thirty-nine; weight 180 to 190 pounds. For three years she had noted a protrusion through the vaginal orifice which was gradually increasing in size. Had some backache much of the time and also had occipital headaches. Otherwise she was in good health.

Physical examination showed a large rectocele involving the posterior vaginal wall from the levator ani muscle to the cervix, which could be made to protrude and form a considerable mass beyond the vaginal orifice. The levator ani muscle and fascia were not much injured. There was a small cystocele. Otherwise the physical condition was good.

The operation employed was, I believe, a new one, and the result has been very satisfactory. These are my reasons for presenting this case. The principle of repair is to utilize the base of the broad ligaments to either side of the cervix for fixation (Fig. 445). The operation requires a denudation extending from the lower border of the rectocele to the posterior fornix and bilateral to the cervix, so as to uncover the rectocele and to expose some of the broad ligaments and levator ani. This would suggest the danger of pulling the uterus down. This feature, however, did not obtain in this individual case, as the uterus was not prolapsed. The operation showed that care had to be used in the placing of the sutures, so that they would not be subjected to too much tension. Care also had to be exercised

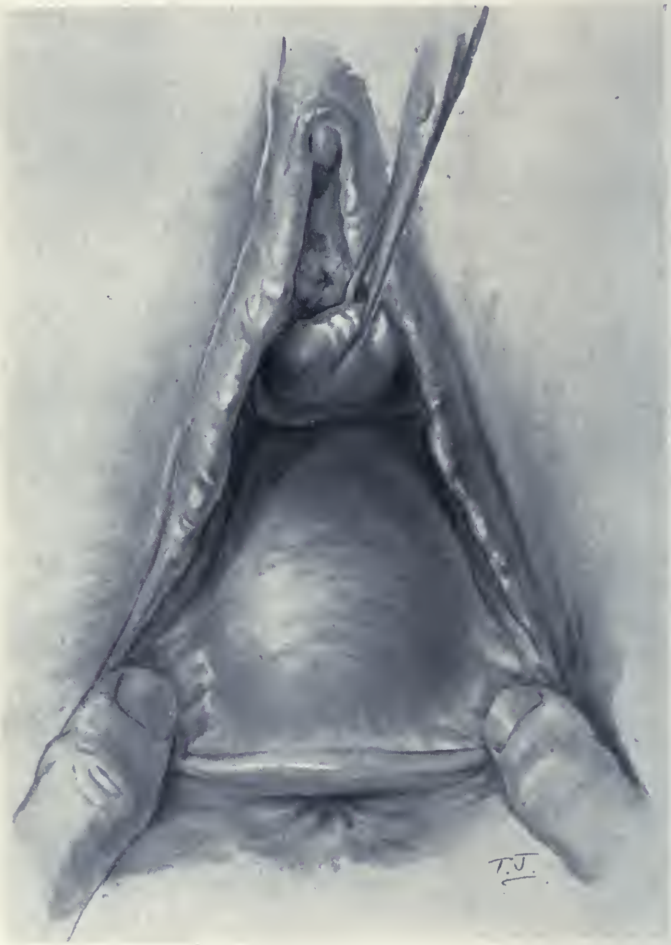

Fig. 444.—A high rectocele. The cervix is drawn downward and forward. There is relatively little defect in the levator ani muscle.

to obtain a fascia for fixation to the broad ligaments. It is also possible to injure the uterine artery or the ureter. This danger, however, is comparatively slight if moderate care is exercised. Aside from the broad ligament fixation there is also an advantage

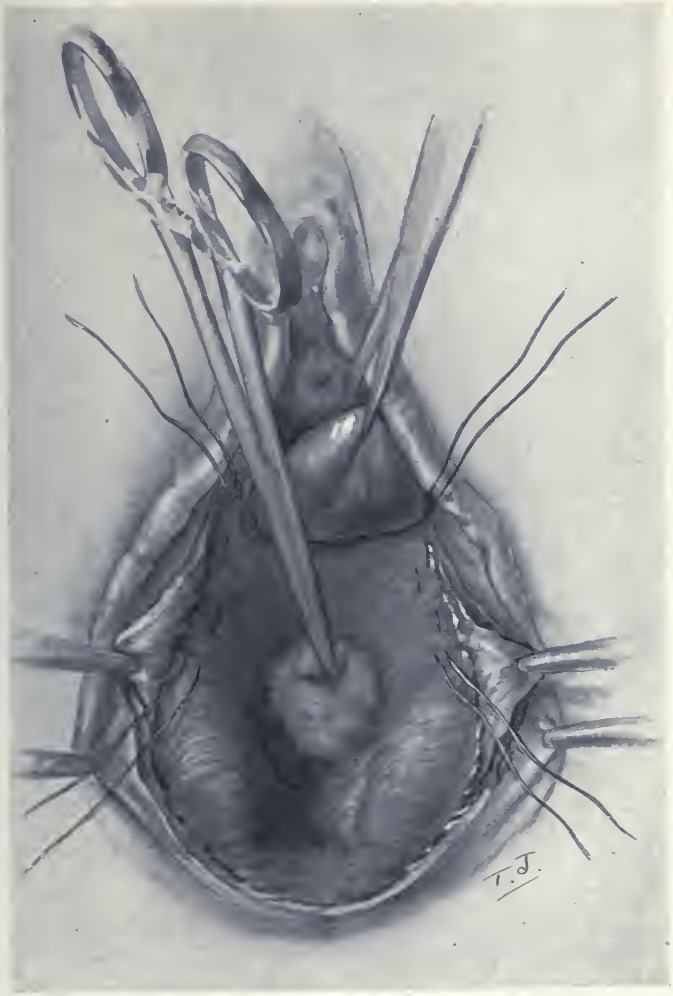

Fig. 445.—Denudation completed; a probang sponge depresses the center of the rectocele. Two sutures on either side unite the bases of the broad ligaments to the rectovaginal fascia.

in obtaining a deposit of connective tissue between the rectal and vaginal walls.

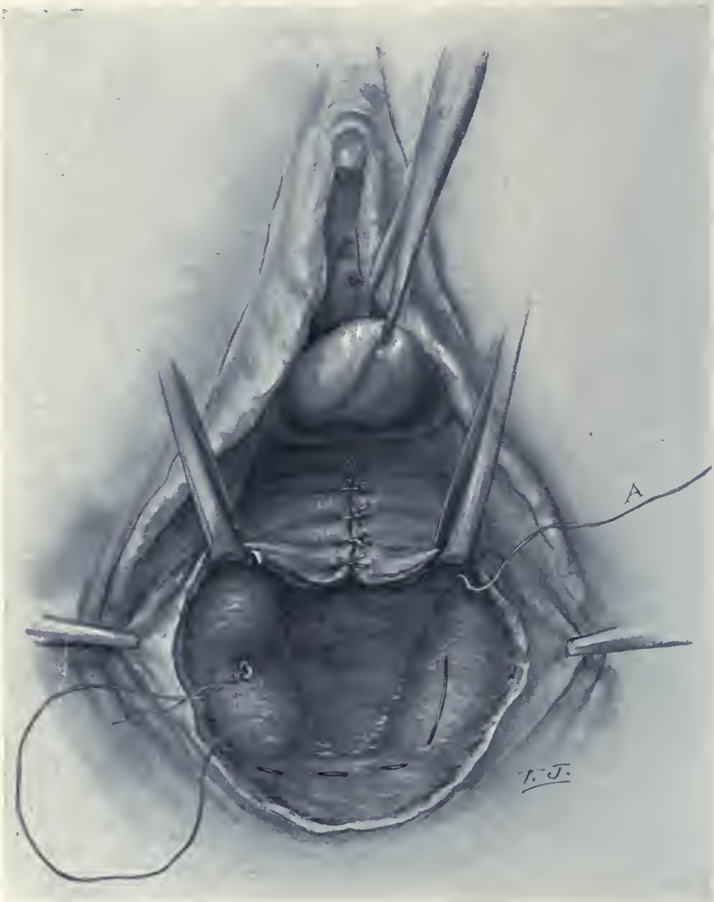

Fig. 446.—The sutures which pass through the broad ligaments have been tied and cut and the upper part of the vaginal canal has been united by suture. Suture *A* is a purse-string suture which enters at the upper border of the levator ani on the left side, approaches the bases of the triangular ligament, and makes its exit at a corresponding point on the right side. When tied this suture closes the hernia of the rectum. It is not tied at this time, as the tying would interfere with the placing of subsequent sutures.

This operation was done December 30, 1918. A recent examination shows a very gratifying result. The time which has intervened gives a good prospect that the result is going to be a permanent one.

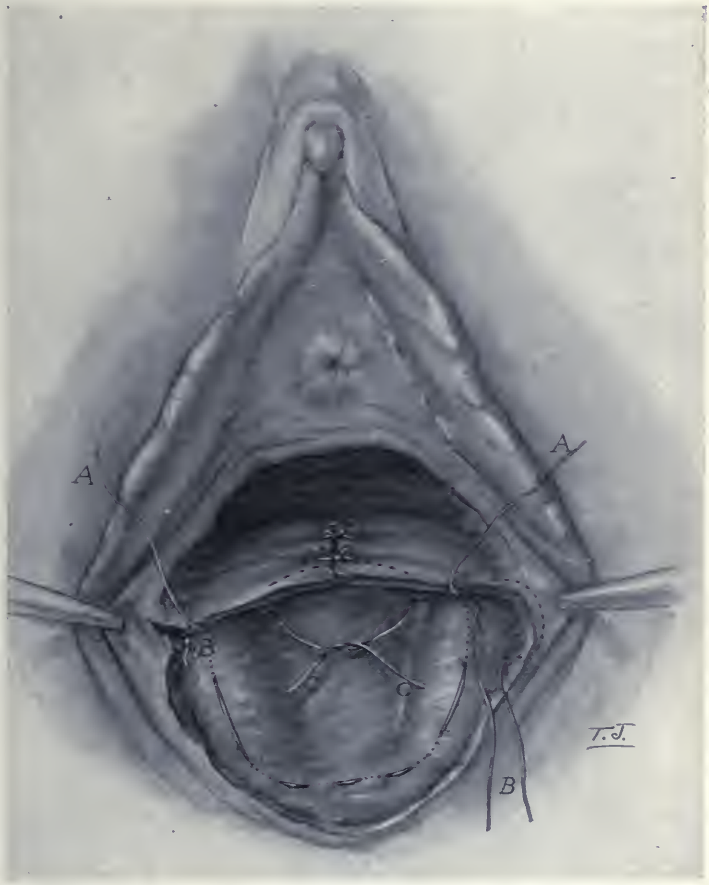

Fig. 447.—Purse-string suture *A* ready for tying. Sutures *B* are subcutaneous in location and close the sulci on either side. *B* is tied on the right, but not on the left. Suture *C*, a submucous suture, is placed so that closure will be complete and lie above suture *A* when tied.

Dr. George Noble, of Atlanta, Ga., has devised and reported an operation for the relief of such cases of rectocele. His operation consists in inverting the rectocele, delivering it through the anus, and excision and suture. It is an operation which shows much ingenuity and there is an excellent chance of relief of the rectocele. It is attended by considerable danger of occurrence of a rectovaginal fistula. My opinion of Dr. Noble's operation is entirely theoretic, as I have not done the operation. I have had experience in a few cases of high rectocele with the usual perineorrhaphy where the operative result has been disappoint-

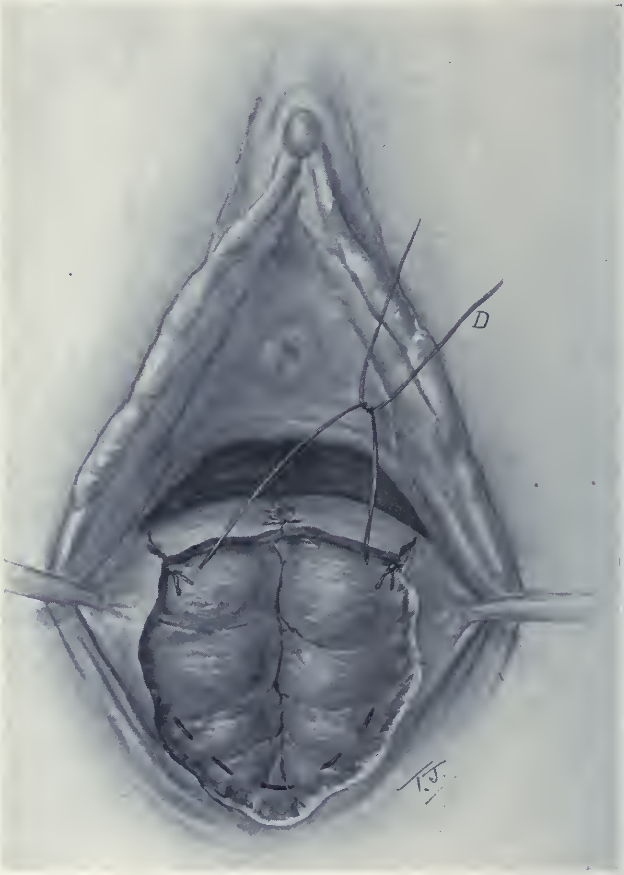

Fig. 448.—Sutures *A*, *B*, and *C* tied and cut. Note that the rectal hernia is completely closed and that the levator ani and fascia are brought prominently into view. Suture *D* is a purse-string suture placed parallel to suture *A*.

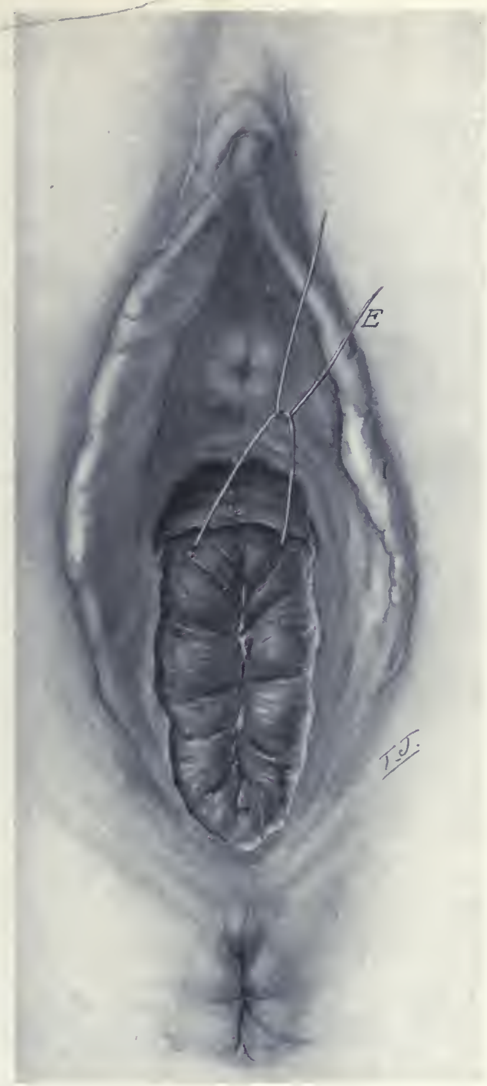

Fig. 449.—Suture *D* has been tied and cut and suture *E* parallels suture *D*.

ing, because when the lower part of the rectocele is repaired the rectum continues to prolapse from a point higher up.

The technic of this operation is shown in detail in the accompanying illustrations (Figs. 444–450). Most of the sutures employed in this operation utilize the principle recommended by

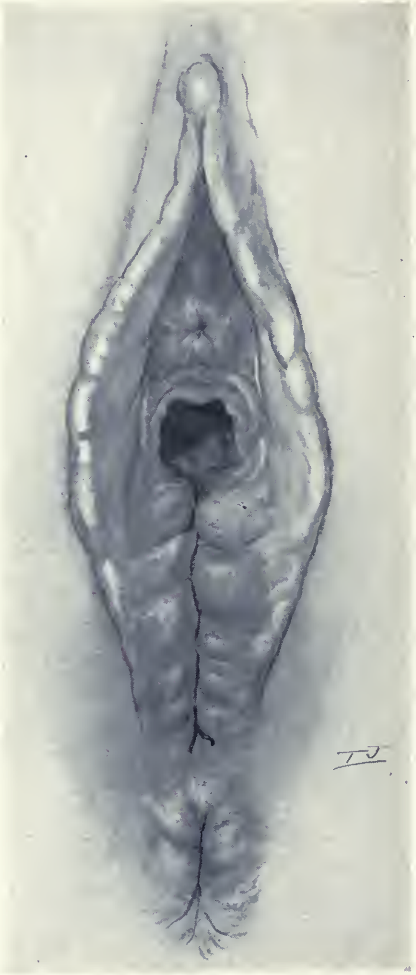

Fig. 450.—Suture *E* tied and the wound closed by submucous and subcutaneous sutures.

Emmet long ago, namely, the advisability of placing the perineal sutures obliquely so that when tied they draw the rectum upward and forward toward the pubes into its normal location.

CLINIC OF DR. HERMAN L. KRETSCHMER

PRESBYTERIAN HOSPITAL

CARCINOMA OF THE BLADDER

Summary: Diagnosis of papillary carcinoma of the bladder; reasons for avoiding resection and fulguration in present case; apparent cure following three applications of radium.

THE patient I wish to demonstrate this morning is Mr. J. W. D., aged seventy-five, who gives the following history:

Family and previous histories are negative.

Present Illness.—Painless hematuria is the patient's only complaint. This began in June, 1918, at which time the hematuria was of only a few days' duration. In ten days he had a second attack which continued for about one week. At times the urine and blood were well mixed, and at other times the hematuria was terminal, according to the patient's statement. Occasionally he would pass large clots. The patient voids every four hours during the day and once or twice at night. He thinks he has lost about 10 or 12 pounds in weight since the hematuria began.

Examination.—Head, neck, and abdomen are negative. The patient wears a truss because of the presence of a right inguinal hernia.

Rectal examination shows the prostate to be normal in size and consistency. The seminal vesicles are soft.

Roentgen ray examination of the urinary tract is negative.

Cystoscopic examination made April 17, 1919, showed the presence of a tumor in the left wall of the bladder behind the left ureteral orifice. The surface of the tumor was irregular and showed a few areas of necrosis. The pedicle could not be seen. The blood-vessels in front of the tumor and running toward the trigone were very distinctly dilated. A piece of the tumor was removed with the cystoscopic rongeur and the pathologist reported it a papillary carcinoma.

Treatment.—The question of treatment was taken up with the patient's physician, and the following methods were considered: Resection of the tumor, fulguration, and radium treatment. Resection, which, because of the close proximity of the tumor to the ureteral orifice, would mean transplantation of the ureter, was not seriously considered, owing to the patient's age. In view of the pathologic report of papillary carcinoma, fulguration hardly seemed promising, and it was, therefore, decided to use radium.

On April 25, 1919, 50 mg. of radium in a sound were introduced into the bladder, placed over the tumor, and left for six hours and fifty-five minutes. On May 2, 1919, 50 mg. of radium in a sound were introduced and left in position for six hours. The patient was asked to return in about two weeks.

Cystoscopic examination on May 13, 1919, showed the tumor to be smaller in size and in several areas the tumor appeared white and necrotic. In front of the tumor edema of the internal urethral orifice was seen. On May 14th a sound carrying 100 mg. of radium was inserted and left for six hours. Patient was asked to return in about six weeks for further observation and treatment.

We will cystoscope him today to see how much benefit he has derived from his three radium treatments.

Cystoscopic examination fails to show any sign of the tumor which was demonstrated at the previous cystoscopic examinations.

In view of the fact that the patient's bladder fails to show the presence of the tumor which was demonstrated at the previous cystoscopic examinations and because of the fact that no other form of treatment has been used, I believe we are justified in saying that the application of radium has resulted in the disappearance of this tumor. The time during which this patient has been under observation is, of course, a very short one. Whether or not this improvement is going to be permanent time alone will tell. I had planned this morning to follow up the radium treatment by the use of high frequency, it having been pointed out by various observers that certain types of bladder tumors that do not respond to fulguration alone will respond very rapidly to a combination of the two methods. Fulguration, of course, will not be necessary because the tumor is gone. I believe if the patient has no metastases that we can look upon him at least for the time being as cured. I will explain to the patient his position and the importance and necessity of repeated observations. Accordingly, we will ask him to come back every three months for observation. It certainly looks like a simple procedure if one is able with radium alone or in combination with fulguration to remove this type of tumor rather than to resort to extensive resection and transplantation of the ureter in a man of this age.

DIAGNOSIS AND TREATMENT OF BLADDER STONE—LITHOLAPAXY

Summary: Signs and symptoms of urinary calculi—methods of examination—rôle of the stone searcher, the *x*-ray and the cystoscope; treatment—open operation versus litholapaxy; technic of litholapaxy; necessity of checking up results of treatment by repeated cystoscopic examinations.

THIS patient, a farmer seventy-seven years of age, was admitted to the hospital April 19, 1919. He gives the following history:

Previous Illness.—At the age of twenty-five he had urethritis. There were no complications and he was apparently cured. Seven years ago he had an acute attack of gall-stone disease which was associated with pain under the right costal arch and jaundice.

Present Illness.—This began three years ago. The symptoms were first noticed while he was working hard on a fruit farm, climbing up and down ladders. Frequency of urination was the first symptom noticed. The frequency was more marked during the day and was less at night while he rested. At times the frequency was worse than at others. As a rule he does not get up at night, but occasionally he is obliged to get up once or twice. The stream is weak and the urine runs slowly, so that it takes a long time to empty the bladder.

Hematuria is a nearly constant symptom, and is aggravated by hard work and by lifting. The blood and urine are well mixed, but occasionally the hematuria is terminal in character. For the past two months he has passed small clots. The hematuria is aggravated by his bladder condition. It is worse when he has an attack of so-called acute cystitis.

Pain on urination began six months ago. He has a desire to urinate and cannot, at which time the pain comes on. This pain is almost always immediately relieved by going to bed or lying flat on the back. Suprapubic pain came on gradually during the past six months. The pain radiates upward along the ureter as far as the crest of the ilium.

Physical Examination.—Head and neck are negative. Pupils react to light and accommodation. Abdomen is negative.

Rectal examination: Prostate is normal in size; consistency somewhat increased. Seminal vesicles are both palpable.

Cystoscopic examination (April 22, 1919): This shows the presence of a stone in the bladder about the size of a pigeon's egg. There is no intravesical protrusion of the prostate. Evidences of very severe edema and generalized cystitis are seen.

Examination of blood: Leukocytes, 9400; hemoglobin, 78 per cent.

Blood-pressure: Systolic, 140; diastolic, 75.

x-Ray examination: Shows the presence of stone in the bladder.

Urinalysis: Clear, amber, 1022; acid, albumin, trace; blood, negative. Microscopic examination shows the presence of pus, epithelial cells, and a few granular casts. Leukocyte count showed 120 leukocytes to the cubic millimeter. Cultures showed the presence of staphylococcus.

COMMENTS

As is well known, stone may be present in the bladder for a long time without producing symptoms. This is the case where the stone is very small, and likewise in instances in which the stone lies in the so-called postprostatic pouch. If one elicits a careful history, it is surprising to see the large number of instances in which these patients give a history of renal colic dating back many years. This symptom is often not mentioned by the patient and is elicited only by close questioning, so that we make it a rule in all our cases of bladder stone to inquire specifically whether the patient has had attacks of abdominal colic. In the case today this was somewhat complicated because of the fact that the patient did have gall-stone colic a number of years ago. That this colic was due to gall-stones is evidenced by the fact that the patient gave a definite history of having had jaundice after this attack of colic. Patients suffering from lesions of the central nervous system, such as tabes, where residual urine in varying amounts may be present, occasionally develop stones, and sometimes these patients carry their vesical calculus around with them for many years unrecognized.

Symptoms.—First, increased frequency of urination. This is perhaps the most common symptom associated with stone in the bladder. Likewise, it is one of the earliest symptoms, and in this case the patient tells us that his first symptom was that of increased frequency of urination. The frequency in vesical calculus differs from the frequency associated with benign hypertrophy of the prostate. Whereas a patient suffering from prostatic enlargement has most of his frequency at night when he is in bed and warm, and during the day his frequency diminishes, a patient with vesical calculus has the frequency most marked during the day when he is up and about, while at night when he is off his feet and in bed he is relieved from the distress of frequent urinations. Patients with frequency of urination due to calculus tell us that the frequency is increased or aggravated by riding over rough roads and by taking automobile or buggy trips. Our patient tells us that his first symptoms were aggravated by going up and down stairs and by climbing up and down ladders. Frequency of urination, however, alone is of little diagnostic value, because frequency of urination is associated with so many other lesions of the urinary tract. Lesions of the kidney are very often associated with frequency of urination, notably pyelitis, renal tuberculosis, and kidney stone. Lesions of the lower urinary tract in men, such as prostatitis, seminal vesiculitis, and stricture; and in women, lesions of the uterus, tubes, and ovaries very often produce frequency of urination.

Painful Urination.—Patients with bladder stone as a rule have more or less pain associated with the act of urination. However, as mentioned above, patients may have small stones without producing any pain, or in instances in which the stone lies in the postprostatic pouch or in a diverticulum there may be no painful urination. Pain may also be produced by other lesions of the bladder, such as tuberculosis and tumors. It was formerly taught that painful urination associated with stone was characterized by the fact that the pain radiated to the glans penis. As a matter of fact, it was taught years ago that when a patient had pain in the glans penis it was pathognomonic of bladder stone. It is not infrequent, however, to see patients with carcinoma of the bladder or prostate who have pain in the glans penis, hence this symptom alone cannot be used as a diagnostic sign. The pain, as a rule, is referred along the urethra or to some part of the urethra. As a rule the pain becomes more severe toward the end of urination. This is due to the fact that as the bladder is emptied the walls of the bladder come in immediate contact with the stone. As the bladder becomes distended with urine the inflamed bladder wall is carried away from the rough surface of the stone, and hence the patient may have little or no pain between the acts of urination.

Hematuria.—Blood in the urine in varying amounts is passed in nearly all stone cases, and, I believe, one may say in every case of bladder stone. In some cases this may amount only to the finding of red blood-cells microscopically. It is quite possible that the first examination may fail to show the presence of blood, but doubtless in repeated and carefully made urinalyses one can find some evidences of blood. Visible blood is present in a large number of these patients. The onset of bleeding may be gradual or it may be very sudden. Not infrequently in cases of vesical calculus the hematuria is terminal in character, doubtless due to the fact that the bladder wall is injured as the bladder is emptied. Many times patients tell us that during the first part of the act of urination the urine is clear, and as they strain to empty the bladder of the last few drops of urine they notice bright blood being emitted.

As with frequency of urination, hematuria is very often aggravated by exercise, exertion, and the jars incident to riding over rough roads.

Mechanical Interruption of the Stream.—Occasionally patients tell us that they have an interruption of the urinary stream; that during the act of urination the stream suddenly stops and they are unable to continue voiding. By a change of posture, sitting down or lying on the back or on one side, or even by waiting a few minutes in the original position, they are able to complete the urinary act. This symptom is a very striking one and not infrequently patients tell us they have a sensation as though something were falling against the neck of the bladder and that this something shuts off the urinary stream.

Diagnosis.—The improvement in the diagnosis of vesical calculus is the direct result of the improvement in modern genito-urinary diagnostic measures. Formerly, as you know, the one single method that was relied upon in the diagnosis of bladder stone was the stone searcher. The stone searcher in the hands of certain urologists was a very valuable aid in the diagnosis of stone. Indeed, a great many of these surgeons were very adept in the use of the stone searcher, so that they but rarely missed a stone when present. This method, however, has a great many limitations and may lead to error. It is easy to see how a stone might be missed in back of an enlarged prostate, and, of course, it would be impossible with a stone searcher to locate a calculus if the stone were situated in a diverticulum. The grating of the stone searcher against the bladder wall has been frequently misinterpreted as due to the stone. The click obtained in carcinomata which are intermixed with urinary salts has also led to an erroneous diagnosis of stone. Whereas the stone searcher was the instrument always used in the diagnosis of stone in years gone by, today it is practically never used, it having been replaced by the cystoscope and the Roentgen ray.

Cystoscopy.—This doubtless is the one single agent at our command which gives us the least number of errors in diagnosis of bladder stone. By means of the cystoscope one is able to determine the size of the stone as well as the number of stones present. Not only does the cystoscope give information on these two points, but it also gives information with reference to the associated pathology which may be present in the bladder. It tells us the condition of the bladder neck and whether or not there is an associated enlargement of the prostate gland. This is a point which should be determined owing to the fact that the treatment depends upon this fact in a large number of instances. It also gives us information with reference to the location of the stone, whether situated in the postprostatic pouch or in a diverticulum. Difficulty may occasionally be experienced in cases of tumors of the bladder which have broken down and become incrusted with urinary salts. It may also occasionally happen that an ulcer of the bladder may show incrustation which may be mistaken for stone. Should any doubt arise in one's mind at this time, it would be easy enough to clear up this point by having the patient roll to one side or the other. A tumor or ulcer with incrustation would remain in its fixed position, whereas a bladder stone would naturally gravitate to the bottom of the bladder. It is quite possible to overlook a stone situated in a diverticulum. This error has been made in the hands of many competent men, and is perhaps one of the limitations in the use of the cystoscope in cases of stone in the bladder.

Roentgen Ray.—The Roentgen ray will always remain an adjunct to the cystoscope in the diagnosis of vesical calculus, and I do not believe that it will ever replace the cystoscope in the diagnosis of this condition. It not infrequently occurs that patients are referred, and we are told that stone in the bladder has been excluded because the Roentgen ray is negative. When one looks at the plates, they are perfectly good ones and no stones show in the Roentgen ray plate. When these patients are subjected to cystoscopic examination one or more stones may be found in the bladder. Not only does this occur in very large, fat individuals, but I have seen several instances in which very thin people were suffering from multiple stones in the bladder, and yet very good roentgenograms, made by the best roentgenologists, failed to demonstrate the presence of stone. The Roentgen ray, too, gives us no information regarding the presence of a coexisting lesion of the bladder that cannot be obtained by the cystoscope. I refer, for instance, to cases of stone forming around foreign bodies that have been introduced into the bladder, such as hairpins and pieces of catheter. The Roentgen ray, of course, does not give information relative to conditions of the prostate, or the presence or absence of tumors in the bladder. The Roentgen ray may give information that may be overlooked by the cystoscope. I refer to cases of stone situated in a diverticulum.

Treatment.—The treatment of vesical calculus falls into one of two groups—the cutting operation and the non-cutting operation. A great deal of discussion can always be elicited whenever the question of treatment of vesical calculus is raised, the adherents of litholapaxy arguing in its favor, and those who lean toward the open operation arguing in favor of the latter.

Perhaps the first one to work out constructive ideas on the non-cutting operation for removal of vesical calculus was Civiale, who lived and worked in Paris about the year 1824. The non-operative treatment of bladder stone only received an occasional stimulus from his time until 1879, when Bigelow, of Boston, promulgated his ideas on this subject. I believe every one is agreed that from the day of Bigelow litholapaxy has come to be recognized as the operation of choice in the largest number of bladder stone cases. The strange part to me is this: Although Bigelow was an American and the modern operation of litholapaxy may, therefore, be called an American contribution to surgery, in the United States litholapaxy is not carried out as universally as it is in other countries, particularly in India and in Continental Europe.

Choice of Operation.—Much can be said with reference to the choice of operation. I think at the present time the tendency of every one in every field of surgical endeavor is to operate. Despite this tendency of the times, it is a fact that there is lack of ability on the part of many surgeons to use the lithotrite, and furthermore, I believe that there is a tendency to disregard the patient. One of the considerations in deciding upon the type of operation is the question of the relative mortality of the open operation as against litholapaxy. Many cases of vesical calculus that are treated and go on to fatal termination die not because of the bladder stone or the method of treatment used in its relief, but the patients die because of complicating kidney conditions which are superimposed as a rule upon the bladder condition, so that it is perfectly fair to say that these patients die a renal death and that this will take place irrespective of the method employed for the cure of bladder stone. The argument is put forth many times that litholapaxy does not offer as sure a cure as does the open operation; that the possibility of fragments remaining and forming a nucleus for a new stone does not exist when the patient is operated upon and the stone removed *in toto*. This, of course, should not be a criticism of the method, but rather a criticism of the man employing it. After each litholapaxy, needless to say, each patient should be cystoscoped before he is finally discharged as cured, and should a small fragment remain, this may be removed by subsequent crushing, by picking it out with forceps, by removing it with an aspirator, or by removing it with any one of the several kinds of operating cystoscopes. The suprapubic operation may result in small fragments of stone being broken off and remaining behind as nuclei for new stones, so that even in these instances in which the patient is subjected to an open operation, one should cystoscope the patients before they leave the hospital. I do not believe that this criticism is a just one. I believe that every patient who is subjected to litholapaxy and is cystoscoped subsequently can be assured that he is cured of his bladder stone just as well as can the patient who is subjected to open operation. It is not, therefore, so much a criticism of the method of operating as it is the neglect to perform subsequent cystoscopic examinations.

The question of the patient's stay in the hospital is one that should be taken into consideration in deciding in favor of one type of operation or the other. The patient who has a litholapaxy performed does not stay in the hospital as long as does the patient upon whom a suprapubic operation is performed. As a rule the patient does not stay in the hospital more than twenty-four or forty-eight hours, and not infrequently in cases in which the stone is small and the infection present in the bladder is very slight, the patient only remains in the hospital for a few hours. Patients who are operated by the supapubic route, therefore, are away from their work a much longer period of time. Their hospital expenses, which are quite an item, are greater, and the number of available beds is reduced. It seems to me that the long period of confinement following suprapubic operation is an item worth considering. The patients have practically the same size wounds as have the patients who have had a laparotomy. There persists for varying periods of time leakage of urine and a sinus persists after the opening in the bladder closes. These two undesirable sequelæ of the open operation may not be present in cases of small stone with little or no infection, in which the bladder can be closed by primary suture, but in this group of cases one would hardly resort to the open operation, but would rather decide in favor of litholapaxy.

The complications associated with litholapaxy are not very great. Occasionally one sees acute prostatitis and epididymitis or urethritis following instrumentation. These, however, are not very common.

Difficulties Encountered in Carrying Out Litholapaxy.—One cannot resort to litholapaxy in every case of bladder stone. It is needless to say that if the patient has a stone due to a foreign body, it would be much better to do an open operation and remove the stone and foreign body. Very large bladder stones in many instances might better be treated by open operation, although some men who practice litholapaxy do not believe that a large stone is ever a contraindication to litholapaxy, and they believe that if all the stone cannot be crushed at one sitting, one might be justified in crushing the stone in two sittings. Needless to say, if one plans to do litholapaxy, one must be able to introduce a lithotrite into the bladder. In cases of urethral stricture this may not be possible, so one may be obliged to resort to dilatation of the stricture or the performing of an internal urethrotomy. Should the stone be secondary to or associated with an enlarged prostate, the treatment, of course, is directed to the enlarged prostate and not to the stone. However, there are instances in which there is only a very small amount of enlargement of the prostate with or without residual urine, and a small stone may be found upon ex-

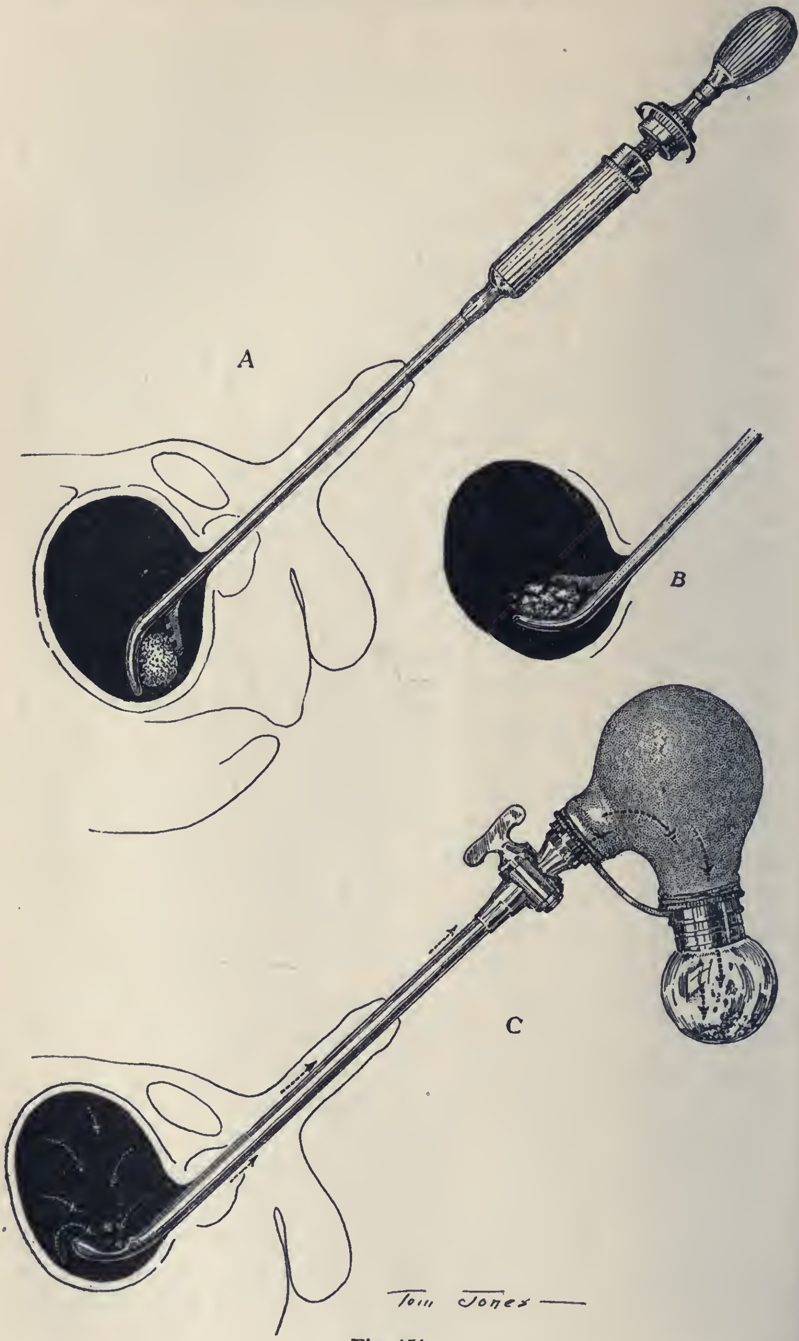

Fig. 451.

amination. It is quite conceivable why one would be justified in crushing such a small stone and carrying the patient along until such a time as he needs prostatectomy. But in the largest number of instances there are severe bladder infection, multiple stones, greatly enlarged prostate, and a good deal of residual urine. This type of case had better be treated by prostatectomy rather than by litholapaxy. Calculi situated in a diverticulum are generally removed by means of suprapubic operation, although occasionally one sees an expert in the use of the lithotrite who can reach into the diverticulum, either crushing the stone in the diverticulum or biting off the fragments and then delivering the stone into the bladder cavity, where it may be crushed. Such a procedure, however, is not entirely free from danger and the wisdom of advising this as routine treatment may be questioned.

There can be no age limit in the employment of litholapaxy, the only essential being that one has a lithotrite small enough so that it may be introduced into the bladder. I have twice crushed stones in boys eight years of age. In women, of course, this procedure is a very simple one, and I believe should be employed more frequently in the treatment of bladder stone in women than it is.

With reference to the treatment of our patient, I believe we are perfectly justified in carrying out litholapaxy. The question of treatment has been gone over very carefully with the patient, who has consulted another man, who advised him to have an open operation. My advice to him has been to have a litholapaxy. There are no contraindications to litholapaxy. There are no complicating conditions in his bladder that need treatment. His urethra admits a large sound, so that I believe we are fully justified in advising the patient to have a litholapaxy.

Owing to the extremely sensitive bladder we are going to do this under gas-ether. Before introducing the lithotrite we will

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Fig. 451.—The calculus is secured and crushed between the blades of the lithotrite (A, B). The lithotrite is then replaced by an evacuating cannula and the bladder is thoroughly irrigated; fragments of calculi as they are washed out of the bladder are caught in the glass bulb of the evacuator (C).

elevate the pelvis so that the stone gravitates away from the neck of the bladder. We will wash out his bladder first with a solution of sterile water until the wash-water returns clear, and then we will distend the bladder with 6 ounces of water. Having done this, I will introduce this lithotrite into the urethra, and as the lithotrite reaches the bladder cavity you hear a click when I touch the stone with the beek of the lithotrite. I will grasp the stone and then lock the forceps (Fig. 451, *A*). The distance at which the lock is set gives you the approximate size of the stone. As I screw down on the handle you hear the stone crack (Fig. 451, *B*). In the operation I will pick out the larger fragments and repeat the operation until I feel all the fragments have been reduced. I do not feel any large fragments nor am I able to grasp large ones in going over the bladder cavity. We will, therefore, remove the lithotrite and introduce this large evacuating cannula and wash out the bladder. In so doing you will see that there is a very small amount of bleeding, and some of the fragments, as you see, are washed out. I will next adjust to the cannula the evacuator and carefully produce suction, by means of which the fragments of stone are washed out and fall into the glass receptacle attached to this evacuator (Fig. 451, *C*). This is done several times. At the end we see no more fragments coming out. In order to be sure that all the fragments are out we will go over the bladder with the cannula, using it as a stone searcher. I do not elicit any clicks. Another way of testing for the presence of fragments is to cause suction and listen for a click of the fragments against the evacuating cannula. Not hearing any, I believe we are justified in claiming that we have removed all the fragments.

The bladder is now washed out with a solution of 1 : 5000 silver nitrate and the patient put back to bed. Before the patient leaves the hospital we will cystoscope him to make sure that we have not left a fragment behind. In case the patient should develop retention of urine or have difficulty in urination, there can be no objection to systematic catheterization or even to the employment of the indwelling catheter. Occasionally one sees patients who develop retention of urine following this sort of instrumentation, and when this does occur, it is a simple procedure to fix an indwelling catheter in the bladder.

(April 26, 1919: Cystoscopic examination shows the bladder to be free from stone. Two small areas of redness and edema are seen, which are the result of trauma. Analysis of the stone shows that it consists chiefly of oxalate of lime with some phosphate. Uric acid and cystin are absent.)

CLINIC OF DR. ROBERT H. HERBST

PRESBYTERIAN HOSPITAL

CARCINOMA OF THE PROSTATE

Summary: Diagnosis; classification of cases from the standpoint of the choice of methods of treatment; indications for the use of radium; introduction of radium needles into tumor—the suprapubic and perineal routes.

THIS patient is sixty years of age; he is married and has 3 children living and well. He gives the following history:

Previous operations: None.

Previous illness: Typhoid thirty-seven years ago; malaria thirty years ago. Pyorrhea alveolaris and joint rheumatism six or seven years ago. Children's diseases, negative. Venereal history, negative.

Present complaint: Presence of blood in urine; difficulty in urinating; pain in the small of the back, and loss of weight.

Onset and course: Two and a half years ago patient came home after a hard day's work and experienced considerable difficulty in urinating. He had no medical attention at the time. Several attacks like this occurred at intervals, and September 1, 1918, after a difficult urination, a good deal of blood was expelled. During these attacks large shreds were passed, blocking the urethra in passing. After their passage urination was less difficult. At the time he first noticed blood in the urine he consulted a doctor, who found residual urine of 1 pint on a number of occasions. After cystoscopic and general examination he was told that he had a carcinoma of the prostate which was inoperable. The hematuria has recurred at intervals following spells of difficult urination. The difficulty on urination is accompanied by frequency and nocturia. The pain in the small of the back is dull and is constant in its location.

Physical Examination.—The patient is a slight man about sixty years old, poorly nourished, with a rather sallow skin. The eyes react to light and accommodation.

Thorax: Heart borders and tones normal; lungs negative; no lymphadenopathy.

Abdomen: Negative.

Extremities: Reflexes normal and otherwise negative.

The urine gives a reaction for albumin and the sediment contains many erythrocytes and pus cells.

Blood examination shows a moderate degree of secondary anemia. Blood-pressure is 146 systolic and 84 diastolic.

Rectal examination: The prostate is large, asymmetric, somewhat nodular, and of stony hardness, extending to the seminal vesicles. It is about the size of a small fist and is fixed, the rectal tissues not being movable on the tumor.

From the clinical history and the above findings it seems quite evident that we are dealing with a carcinoma of the prostate gland. In making a diagnosis of carcinoma of the prostate we take into consideration that we find all the symptoms and signs of ordinary hypertrophy, but they are more severe. There is a greater likelihood of finding hematuria, terminal or otherwise. There is pain at the end of urination. There may be pain accompanying the sexual act. Frequently there is pain in the rectum, radiating up the back and down the thighs along the sciatic nerve. The prostate, on palpation, is found to be of stony hardness, irregular, asymmetric, and nodular. The rectal tissues are not movable on the tumor and the tumor appears to be fixed. Loss of weight and strength and marked secondary anemia are found. The case we have here has advanced to the point where neither enucleation nor excision is advisable, but it is a suitable case for radium treatment. Radium treatment of deep-seated neoplasms, such as those of the prostate, has not been very satisfactory because of the difficulty of bringing the radium directly into contact with all parts of the involved area. This direct contact is best accomplished by exposing the tumor either from above or below by cystotomy or perineal section, and inserting several hollow needles containing radium directly into the mass, thereby reaching the most remote parts of it. Radium introduced into the bladder by means of a sound is not accurate in its application and is only superficial in action. The same may be said when it is introduced into the rectum. It has also been noted that radium when left in the rectum for even a comparatively short time gives rise to a severe toxic reaction. By introducing the radium directly into the involved tissue we are sure that its activity is accurately directed, and our experience has proved that even such long exposures as twenty-four hours give rise to practically no toxic reaction. At the same time the tumor tissue receives a maximum dosage of radium.

In selecting cases for this method of treatment one can make the following simple classification:

1. Those cases in which the lesion consists of a benign hypertrophy undergoing malignant degeneration or accompanied by beginning malignancy. These tumors are, as a rule, readily enucleated, and it is only on being examined microscopically that they are discovered to be malignant. This type is often benefited and sometimes cured by simple enucleation or by excision as described by Young.

2. The other extreme, in which the surrounding tissues have become involved, metastases have developed, and there is a marked degree of anemia and cachexia. This type is beyond any form of treatment other than possibly drainage of the bladder to relieve retention.

3. The third class of tumors begin as malignant growths in the lower periphery of the gland, and gradually spread along the posterior part of the prostate to the seminal vesicles and ejaculatory ducts. These tumors when discovered are usually too far advanced for radical removal, but the symptoms can be greatly relieved, life prolonged, and the patient possibly cured by the judicious use of radium applied by means of needles introduced directly into the tissues.

Our present case falls into this last classification, and we shall now proceed to apply the treatment.

Operation.—On making a suprapubic cystotomy with a

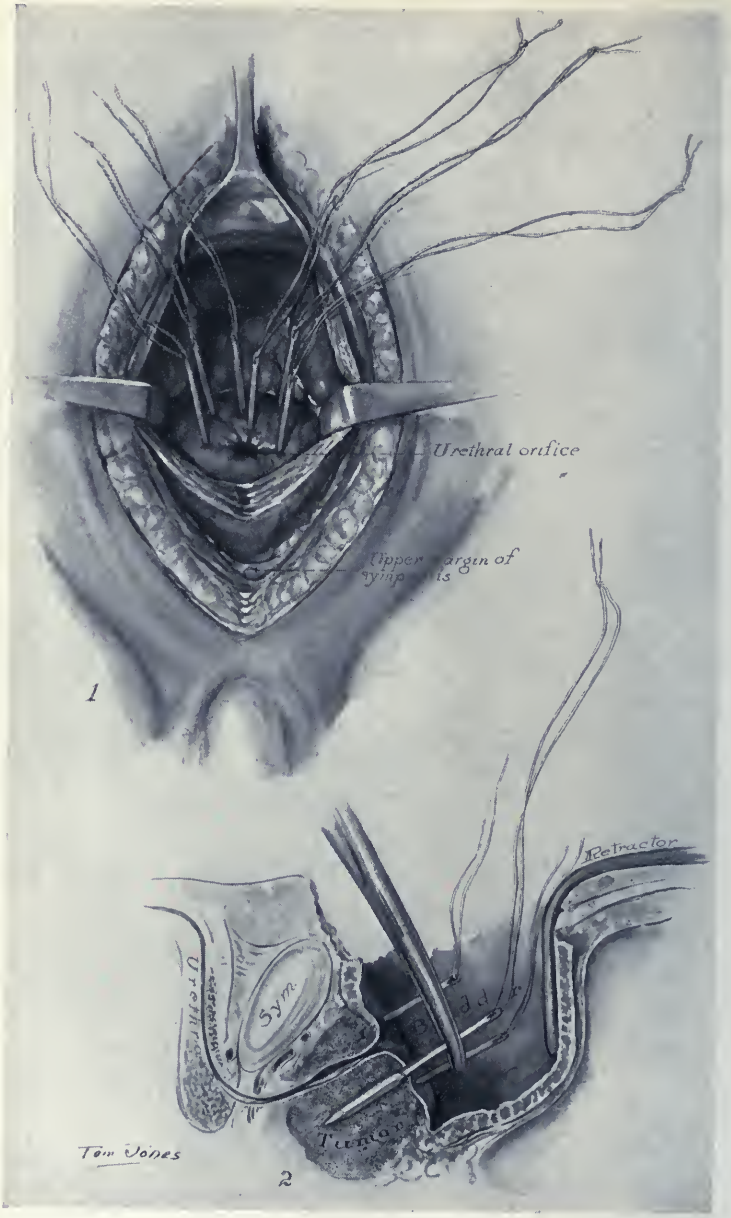

Fig. 452.—1, Radium needles inserted into prostatic tumor through cystotomy incision. 2, Schematic sagittal section illustrating the direction in which the needles are pushed and the depth to which they are carried.

rather liberal high incision into the bladder wall, we have, by the aid of carefully placed, long retractors, a good view of the entire interior of the bladder. There is no evidence either on inspection or by palpation that the posterior bladder wall has become involved by the growth. We do not find any visible growth in the bladder and there is a definite line of demarcation between the prostatic mass and the bladder wall. Where the bladder wall is infiltrated by the tumor there is a continuous

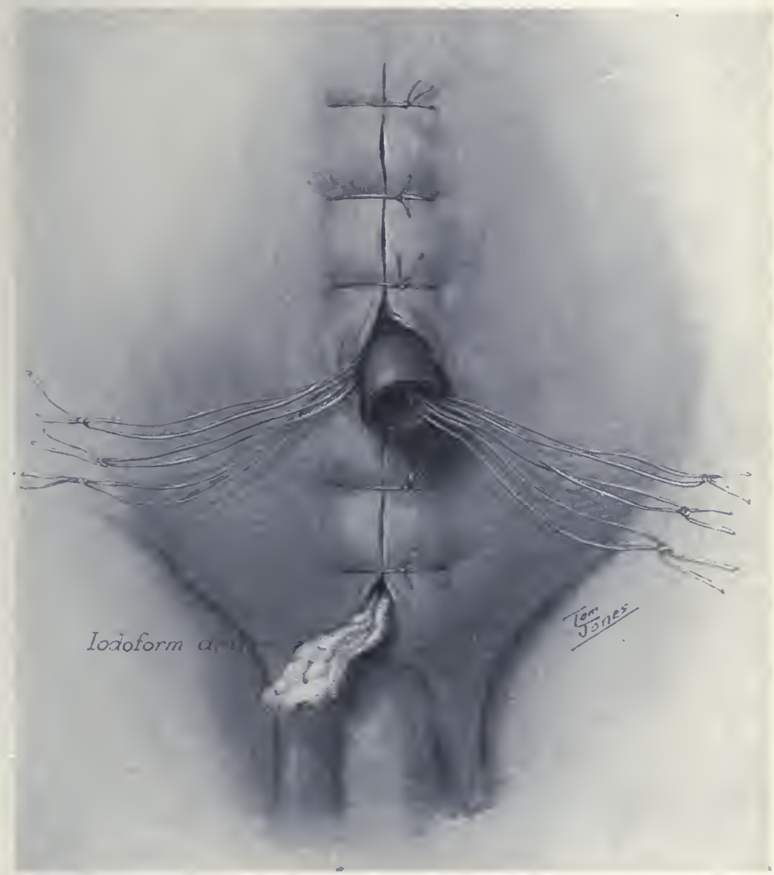

Fig. 453.—Wound closed with drainage; the threads attached to the radium needles have been carried out through the drainage opening.

mass without a clear line of demarcation between bladder wall and tumor. We will now introduce the needles, each containing 10 mg. of radium, through the bladder wall into the substance of the prostatic tumor, using care to place them at such distances apart that all parts of the tumor are about equally subjected to their influence. An assistant with his finger in the rectum helps

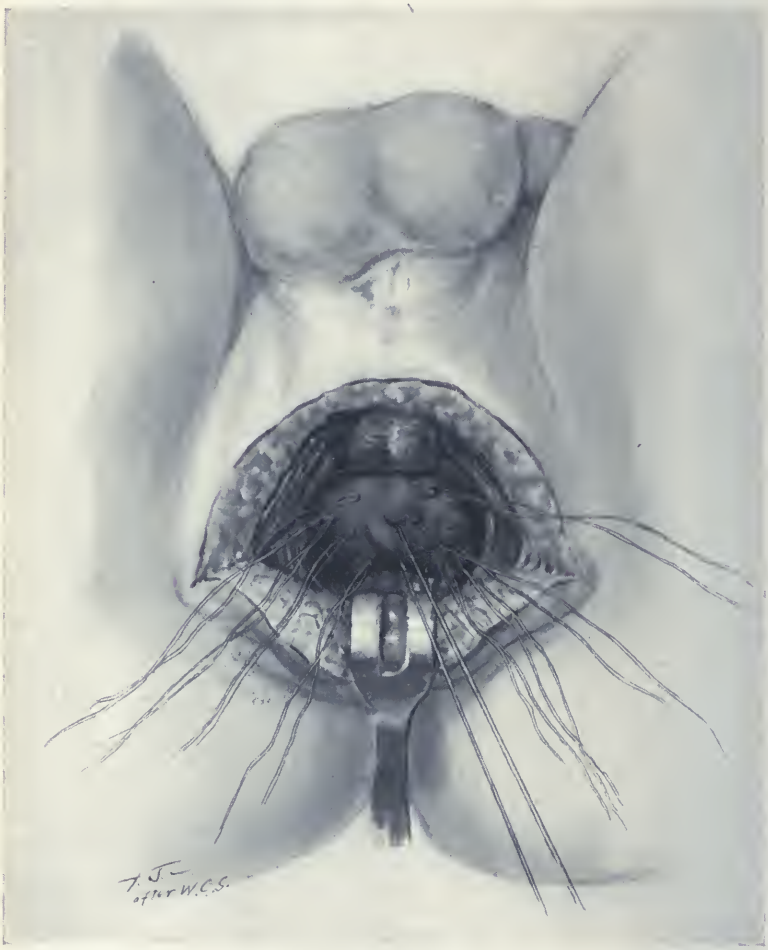

Fig. 454.—Insertion of radium needles into carcinomatous prostate through perineal incision.

to guide the placing of the needles, safeguarding against pushing the needles through into the rectum, and at the same time seeing that they are introduced well into the involved tissues. In this case we have used six needles (Fig. 452, 1, 2). A strong silk thread is passed through the eye of each needle and the loose ends of these threads extend out through the cystotomy incision (Fig. 453). The loose ends of the threads are retained and kept from slipping into the bladder by being confined between folds of adhesive plaster. In from twelve to twenty-four hours, depending on the degree of reaction, the needles are removed by gentle, steady traction on the silk threads. Subsequently the bladder is kept clean by irrigating several times daily through the suprapubic opening with warm boric acid solution and the wound is allowed to close. If the entire mass does not disappear after this exposure and we find the lower portion of it is still enlarged, we make a second exposure in from four to six weeks. This is made by making a dissection into the perineum, obtaining complete exposure of the lower part of the prostatic mass, and introducing the needles from this direction (Fig. 454). It is well to make the upper exposure first, because following the introduction of the radium a temporary swelling occurs, which is likely to cause complete retention should the lower application be made first without the prophylactic cystotomy.

Subsequent history and course: The following day the six needles were removed after being in the prostatic tissue for twenty-four hours, there having been no unfavorable reaction necessitating removal earlier. This made the total dosage of the radium exposure 1440 milligram hours. A rectal examination made a week later revealed beginning softening of the mass. Further progress will be reported.

NEPHROLITHIASIS

Summary: Diagnosis of renal calculus; renal functional capacity as a guide in treatment; pyelotomy—removal of large stone from pelvis and a smaller one from calix through same incision; fallacy of attributing symptoms to low position of kidney in multiparous women.

Our next patient is thirty-two years of age and married, with 3 children living and well. The past general history is negative and her three confinements have been normal. She complains of backaches, pain in the loin and right side, headaches, and vertigo.

The backache began two and a half years ago, after her last confinement, as diffuse pain following unusually heavy housework. At first the pains were not very severe and not definitely localized. Later they became more severe and more frequent. About eight months ago they increased in severity and localized in the right side, radiating to the right thigh, and were associated with headache, vertigo, and nausea. During the last few months the attacks have been so severe that it has been necessary for her to go to bed and be given an opiate. The attacks have lasted about ten or twelve hours. During the last three months there have been five such attacks. A physician consulted about a year ago, finding that he could palpate the kidney very easily, made a diagnosis of movable kidney, and prescribed a pad and belt to hold it up. The pressure from this pad did not relieve her symptoms, but increased her discomfort to a marked degree. It is well to remember in this connection that it is not at all unusual to find that the right kidney is situated very low in women who have had children. This is so common that we can hardly consider it abnormal.

Physical Examination.—Head and neck, thorax, and extremities are negative.

Abdomen: There are no tumors felt, but there is marked tenderness on the right side, not accompanied by muscle spasticity. This tenderness is also marked in the small of the back and corresponds to the site of the right kidney. The right kidney is readily palpated and the upper pole comes down well below the costal arch on deep inspiration.

Cystoscopic examination shows the bladder to be negative. Catheterization of the ureters shows a diminished flow from the right kidney.

A functional test, using phenolsulphonephthalein intravenously, gave the following results:

	Right kidney.	Left kidney.
Time of appearance	0	3 minutes
First half hour	0	40 per cent.
Second half hour	0	12 per cent.
Total	0	52 per cent.

Blood chemistry tests gave the following results:

Urea	150	mg. per liter
Chlorids	5.32	gm. per liter
Carbon dioxid	46.2	c.c. per liter
Nitrogen	24.1	gm. per liter

Urine cultures were negative.

Cell count: Right kidney, bloody; left kidney, 8 cells.

x-Ray plates show three distinct shadows, indicating that there are three calculi, one very large one appearing to be in the renal pelvis, a small one in the middle calix, and the smallest one in the kidney substance near the lower pole. The *x*-ray findings explain very definitely why the wearing of the pad caused the symptoms to be aggravated. One can readily see that such a contrivance would cause pressure on the kidney, squeezing it between the pad on one side and the stones on the other (Figs. 455, 456).

The treatment of nephrolithiasis, unilateral, and with the function of the other kidney good, is obviously the removal of the calculi.

Operation.—Under general anesthesia we make the usual oblique kidney incision. The kidney is exposed and freed from its fatty capsule. Because of an aberrant blood-vessel at the upper pole it is not possible to deliver the kidney entirely. An assistant holds the kidney and turns it forward, which brings the dilated pelvis containing a large stone into better view.

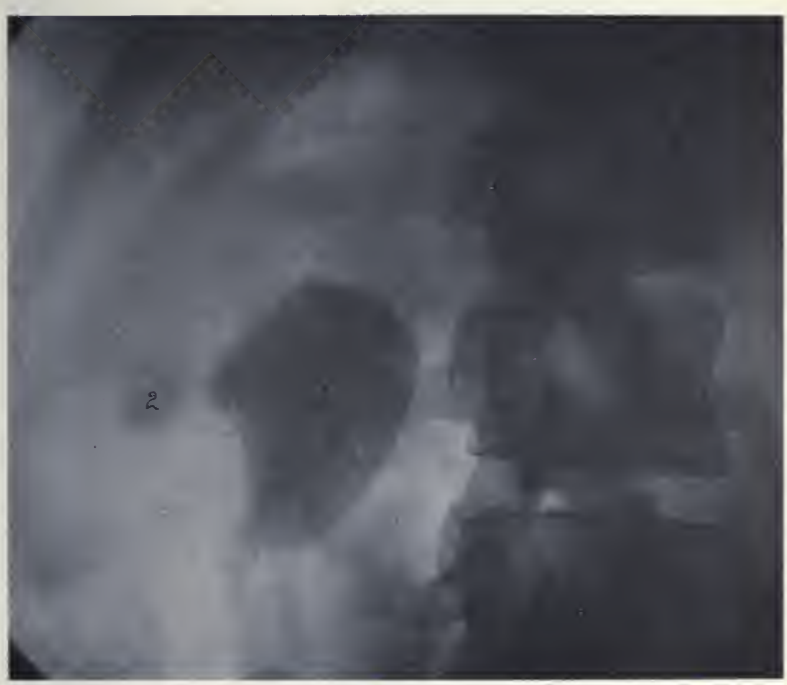

Fig. 455.—*x*-Ray photograph of patient showing multiple renal calculi. The shadow of the third calculus mentioned in the text does not appear in this print.

We incise the pelvis, beginning our incision at the insertion of the ureter and cutting toward the kidney. The large stone is now in plain sight and by means of a calculus forceps we carefully lift it out (Fig. 457, *A*). With a finger through the incision in the pelvis we locate another stone in the middle calix. This we remove by means of a scoop. Further investigation reveals no other stones in the pelvis or calices. The stone which appeared to be in the kidney substance cannot be palpated, and we do not think it advisable to incise the kidney in an attempt to remove it. Small stones in the renal parenchyma, as a rule, do not cause any trouble, and we do not feel justified in damaging the kidney in an attempt to search for it. We close the pelvic incision with interrupted catgut sutures (Fig. 457, *B*) and insert a small rubber drain and a strip of iodoform gauze down to the kidney. The incision is closed in the usual manner. Very little blood has been lost and the patient leaves the operating room in good condition.

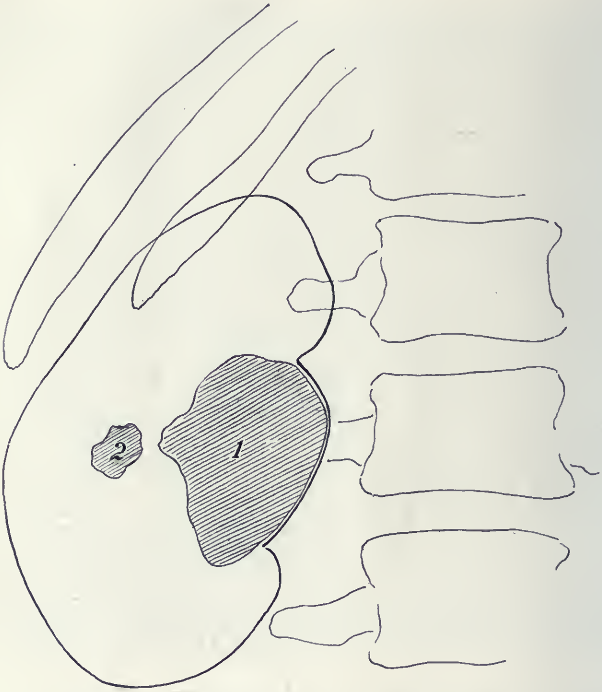

Fig. 456.—Schematic outline made from x-ray plate (Fig. 455) to show relation of the calculi (1, 2) to the kidney.

Postoperative History and Course.—Two days later the gauze drain was removed. Four days later the rubber tube was removed. There has been no oozing and the wound is healing

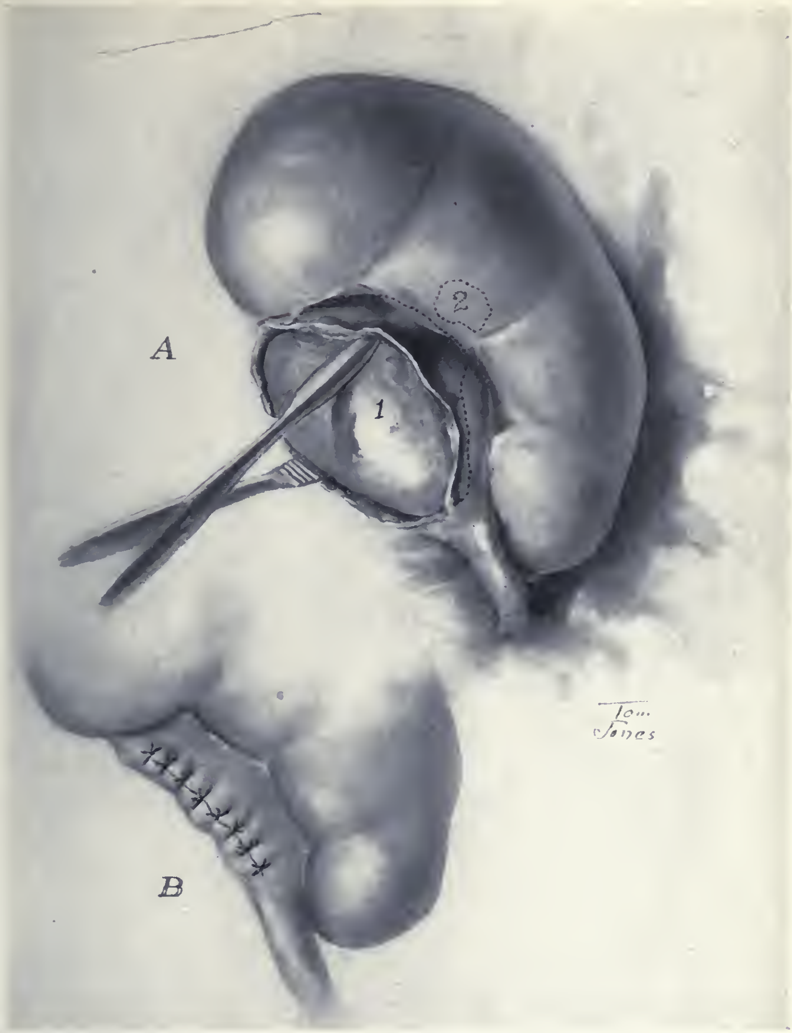

Fig. 457.—*A*, Delivery of large calculus from renal pelvis. *B*, Rent in wall of kidney pelvis closed by interrupted sutures preparatory to returning kidney to its normal location.

nicely. Twelve days later the sutures were removed. The entire convalescence has been uneventful.

HYPERTROPHY OF THE PROSTATE GLAND IN A CASE OF PROBABLE HODGKIN'S DISEASE

Summary: Prostatic enlargement associated with enlargement of inguinal glands suggesting malignant disease of the prostate; differential diagnosis; clinical and pathologic demonstration of character of lesion; prostatectomy.

Mr. G. complains of difficulty on urination accompanied by nocturnal and diurnal frequency. He is sixty-five years of age, married, and has a wife and 5 children, all living and well. His past history is rather uneventful.

About eight months ago he began to have difficulty in urinating and had to get up two or three times at night, passing only a small quantity each time. These are practically his only symptoms and they have gradually been getting worse. On consulting his family physician he was informed that he had an enlarged prostate which would require removal to relieve his symptoms. Another physician, who examined him later, told him the same. On consulting us, we elicited the information that his difficulty in urination consisted in a delayed starting of the urinary stream, accompanied by diurnal and nocturnal frequency. The stream after starting was slow and thin, but never stopped suddenly. He has never passed any blood. He noticed some large nodules in the groin on both sides and similar nodules in both armpits. These nodules were first noticed at the time the urinary symptoms began. Since having this urinary trouble he has lost from 25 to 35 pounds and has become correspondingly weaker.

Physical examination reveals a poorly nourished man, quite normal in most respects. The cervical glands vary in size from that of a bean to that of a peanut kernel. The inguinal glands are visibly enlarged, especially those below Poupart's ligament. The largest is about the size of a walnut and the smallest about

1 cm. in diameter. The axillary glands are similar, but average smaller in size (Fig. 458).

Rectal examination reveals a moderately enlarged, symmetric prostate; the enlargement is not of the stony hardness which is usually characteristic of malignant growths originating in this organ.

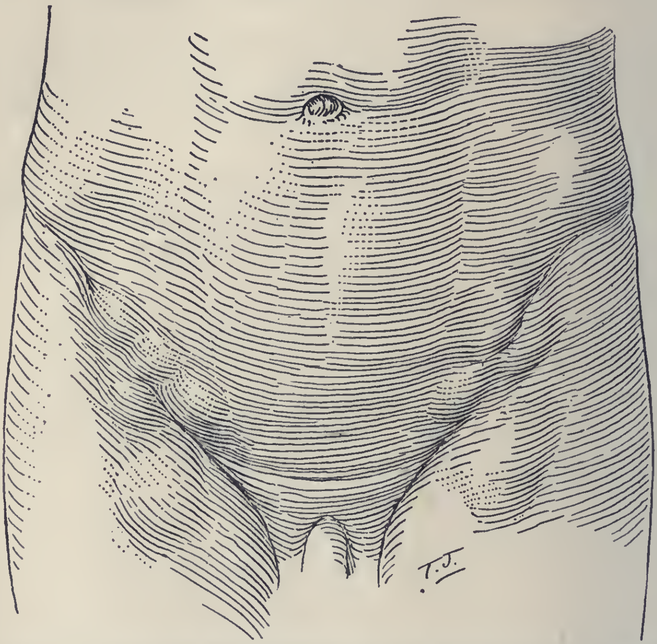

Fig. 458.—Sketch showing enlarged inguinal glands which, in association with an enlarged prostate, caused a malignant enlargement of the prostate to be suspected until sections from the glands were shown to resemble sections from the glands of Hodgkins' disease rather than those of metastatic carcinoma.

Cystoscopic examination reveals a moderate degree of cystitis with some trabeculation of the bladder wall. The prostate projects into the bladder to a moderate degree and the ureteral orifices are apparently normal. There is residual urine of about 12 ounces.

The urine contains no albumin, sugar, or casts, but pus-cells and a few red blood-cells are found.

Blood chemistry shows:

Urea	140	mg. per liter
Chlorids	4.9	gm. per liter
Carbon dioxid	47.1	c.c. per liter
Nitrogen	19.9	gm. per liter

The Wassermann is negative.

The question arises, Have the enlarged inguinal glands anything in common with the enlarged prostate, or are we dealing with a benign prostate, the enlargement of the glands being due to some other cause, such as Hodgkin's disease? The glands usually first involved in carcinoma of the prostate are the sacral nodes on either side of the internal and external iliac vessels and those which follow the pudic. The enlargement of the inguinal glands usually appears later in the course of the disease.

On rectal examination the prostate reveals none of the usual characteristics of carcinoma, and we feel justified in enucleating it. Two weeks ago we removed one of the inguinal glands for microscopic examination. This did not give any evidence of malignancy, but showed only a chronic hyperplasia of the lymphoid tissue resembling the findings in Hodgkins' disease. Irrespective of the fact that he has this glandular disease, the removal of the prostate is indicated to relieve his urinary symptoms, as he has a large residual urine and catheterization is quite difficult.

Operation.—A two-stage prostatectomy was decided upon, and ten days ago a cystotomy was performed under local anesthesia and a drainage-tube left in the bladder for three days. Subsequently the bladder has been irrigated with a solution of boric acid. Today we are going to do the second stage of the operation under general anesthesia. We enlarge the suprapubic opening and proceed to enucleate the prostate by finger dissection. The lateral lobes are readily shelled out, but the median lobe is slightly adherent. There is practically no bleeding and the wound is closed about the drainage-tube without packing the cavity.

Subsequent history and course: The healing was uneventful.

The patient was up in a wheel chair after the seventh day. This case is of interest because of the enlarged inguinal glands, which suggested the possibility of malignancy of the prostate. Our investigation gives us much evidence that there is no connection between the enlarged prostate and the enlarged lymph-nodes. Following is the report of the pathologist:

Sections from Inguinal Glands.—Chronic hyperplasia, decrease of lymphoid tissue, increase in fibrous reticulum and in the endothelial and plasma cells. Numerous large multinuclear giant cells not of the Langhans' type. Many areas of necrosis, which are apparently ischemic. Very few eosinophils. No typical tubercles or other usual signs of tuberculosis. Probable diagnosis: Hodgkin's disease.

Sections from Prostate.—Moderate increase in glandular structures; great hyperplasia of interstitial tissue, with a good deal of lymphoid infiltration; no evidence of tuberculosis or malignancy; no similarity to lymph-node above. Diagnosis: Chronic hyperplasia.

CLINIC OF DR. CAREY CULBERTSON

Cook County Hospital

OVARIAN CYST AND CHRONIC PYOSALPINX: DIAGNOSIS AND TREATMENT

Summary: Differential diagnosis of strangulated ovarian cyst; technic of operative removal; methylene-blue in novocain solution as a guide to the extent of infiltration of the anesthetic; chronic pyosalpinx—diagnosis; technic of operation; defundation of the uterus; utilization of sigmoid colon in peritonizing posterior culdesac.

Our first case is that of a woman fifty-eight years of age. She enters the hospital complaining of pain in the lower abdomen. She has noticed a gradual increase in the size of the abdomen during the past few years. By way of occupation she does housework, and while so occupied on the 5th of this month (April) she was seized with a sudden pain in the abdomen. This was so severe as to require her to stop working. She went home, went to bed, and called a physician, who administered an opiate, after which she experienced relief. She remained in bed for three days, but since getting up has been unable to work because of the pain in her abdomen, particularly in the right side. The patient gives the following history:

Menstrual.—Menses began at fourteen. They occurred regularly every twenty-eight days, lasted three to five days, and were moderate in amount and free from pain. The menses ceased when she was forty-two or forty-three years of age. She has had three children, all of whom are living and well and of adult age. All three pregnancies were normal and the three labors were spontaneous. She denies having had a miscarriage and states that at no time did she ever bleed profusely at menstruation, nor has she ever had hemorrhage between menstruations. Likewise, there has been no history of a vaginal discharge. She does not give constipation as one of her symptoms, stating that she has always been able to keep the bowels regular with the ordinary domestic remedies. There has been no diarrhea during the past month or since the acute onset on the 5th of this month. There has been some frequency of urination, not, however, associated with pain. There is no history of fever or chills.

Upon examination, this patient is found to be a well-nourished woman of healthy appearance. The head is negative. Nose, throat, eyes, and ears are apparently not at fault. The thorax is negative, and the heart and lungs normal. The abdomen is distended, the walls, however, being soft and elastic. If anything, they are somewhat relaxed in the region of the evident distention. In the lower portion of the abdomen the percussion note is dull, giving rather the characteristic appearance of an eight months' pregnancy. On palpation, however, this distention feels rather soft but distinctly cystic, and appears to fill the abdomen, particularly on the left side. Above the area of dulness there is tympany such as characterizes the abdomen normally.

On rectovaginal examination we find that the vaginal outlet is relaxed. The vagina is short and constricted. The cervix is atrophic, but free. The corpus uteri is atrophic, small, hard, and upright. In other respects the pelvis is negative. High up on the left side a cystic mass can be felt by bimanual palpation, this mass being apparently the lower portion of that which occupies the abdominal cavity.

The appearance of this patient, the findings on examination, and the history of the sudden onset of pain make a fairly accurate diagnosis possible—that of ovarian cyst, probably with twisted pedicle. There are, however, other things which must be borne in mind or differentiated from this. In this particular case the differentiation from pregnancy is not necessary, as this patient is past the years of reproductive activity, so that a normal uterine or ectopic pregnancy at or near term may be left out of consideration. Fibroids of the uterus must be taken into consideration, but the fact that the uterus is palpated so readily and shows the changes of senile atrophy such as would be normal at her age, and the fact that the distention of the abdomen is plainly due to a soft cystic mass or fluctuating tumor instead of a hard, board-like movable tumor, such as a fibroid of the uterus, make us believe that we can fairly definitely rule out a fibroid tumor of the uterus.

Even were this tumor a cystic fibroid we should expect its wall to be firmer and harder than is demonstrable. It must be granted, however, that such differentiation is difficult, and often only probable.

Cystic tumor of the kidney may produce a condition very like that of simple ovarian cyst. Congenital cystic kidney, however, is usually discovered earlier in life, and is in almost every case bilateral. Certainly we must not leave such a possibility out of mind. Its growth is very slow and it produces a very asymmetric enlargement, always from above downward.

Parovarian cyst seldom rises so high in the abdomen, and, being retroperitoneal, or intraligamentous, would not be free in the abdominopelvic cavity; neither would it be pedunculated. This tumor grows primarily in the pelvis and fills it from below upward, often presenting as a bulging mass pushing down the vaginal fornices, giving the impression of impaction in the pelvis.

Fat in the abdominal wall is occasionally mistaken for an abdominal tumor. In this particular case our patient is not obese, nor is her abdominal wall pendulous.

Phantom tumor, usually due to distention of some portion of the large bowel, has been ruled out as a probable diagnosis by careful observation of the patient during the six or seven days since she has been in the ward.

Ascites or free fluid in the pelvis is another condition which must be borne in mind. In this particular case the dulness is apparent and retains its position in the abdomen regardless of the attitude of the patient, and further, we are unable to make out another condition which would be a factor in the production of ascites. There has been no loss of weight; there has been no pain comparable to that of malignancy; there have been no hemorrhages; there is no palpable enlargement of the liver or of the spleen. There is no mass palpable at the gastric or pyloric regions. In other words, we have no reason to suspect an abdominal malignancy in this case. Likewise we have no cardiorenal disturbances and nothing upon which to base a diagnosis of myocarditis, valvular lesion of the heart, or nephritis. Encysted ascites, such as is produced by tuberculous peritonitis, may give a picture somewhat like ovarian cyst upon inspection. On palpation, however, the outline is less distinct and its volume is never free or movable. Tympany is apt to be present all over the tumor, and there should be a history of some pre-existing peritonitis at the same time; if our diagnosis is correct there probably will be a small amount of fluid free in the peritoneal cavity.

The patient has run an afebrile course in the hospital. Examination of the urine shows no albumin or casts, no sugar, and no blood or pus. The hemoglobin estimation read 85 per cent., the leukocyte count, 8400.

With the diagnosis, therefore, of ovarian cyst more than ordinarily definite in this particular case, operation for its removal will now be undertaken.

For the purpose of a median abdominal incision we will infiltrate the abdominal wall with 1 per cent. novocain solution. This has been stained with methylene-blue for the purpose of discoloring the infiltrated tissues, so that the extent of infiltration can be readily seen before the operation is proceeded with. It is important in working with novocain anesthesia to wait about one minute after injection before making the incision in order to give the novocain an opportunity of infiltrating throughout the tissues.

The incision is a median one, about 5 inches in length, beginning below the umbilicus and terminating about three fingerbreadths above the symphysis. The incision will not be carried lower, because in these cases one can never be sure whether or not the bladder has been elevated into the abdomen by the tumor. It is extremely important in opening an abdomen distended by a tumor not to carry the incision too low at first. Upon reaching the fascia the novocain is again injected. The incision through the fascia shows that the abdominal recti are separated. These are dissected from their sheaths on either side as we go in, so that in closing our wound they will be brought together and the diastasis overcome. Another point with respect to the incision in this particular case is that I open the abdomen in this manner because I do not anticipate delivering this cyst *en masse.* In my opinion it is free in the abdominal cavity, that is, there are no adhesions holding it fast at any point. If there are, and if it becomes necessary to deliver this cyst *en masse*, we can very easily extend our incision upward or downward as seems best for that purpose, but if the cyst is, as I suspect, free in the abdominal cavity, it will be simply a thin-walled unilocular cyst containing thin fluid which can be evacuated and delivered through a comparatively small incision.

The peritoneum is seen to be stretched over the wall of the tumor lying beneath it, but on picking it up it can be elevated a short distance above it. It is opened throughout the entire length of the incision, that is, approximately 5 inches, and exposes, as we suspected, a portion of the cystic tumor (Fig. 459, 1, 2, 3). With self-retaining retractors the edges of the wound are spread apart, and I will now introduce into the cyst through the lower angle of the incision a trocar. This is done very readily, and permits, as you see, the escape of a dark brown, thin fluid which runs out readily. As this fluid escapes the cyst gradually diminishes in size, and as it does so, its walls are picked up with forceps and held in approximation to the abdominal wound. This fluid is, as you see, considerable in amount, having filled one of these large-sized basins. As the cyst collapses it is very readily brought out through the abdominal incision and it is evident that there are no adhesions.

I now pack off the intestines with a large gauze pad and proceed to deliver the collapsed cyst wall through the wound. It comes out readily, and upon delivery we find that while it has occupied the left side of the abdomen more completely than the right, it comes from an attachment on the right side originating from the right ovary. Also, as we suspected, the pedicle of the cyst is seen to be twisted from right to left. We turn the cyst out to the right and find that the pedicle straightens out in one and a half turns. A clamp is now placed just below that point on the broad ligament where the twist of the pedicle ceases and

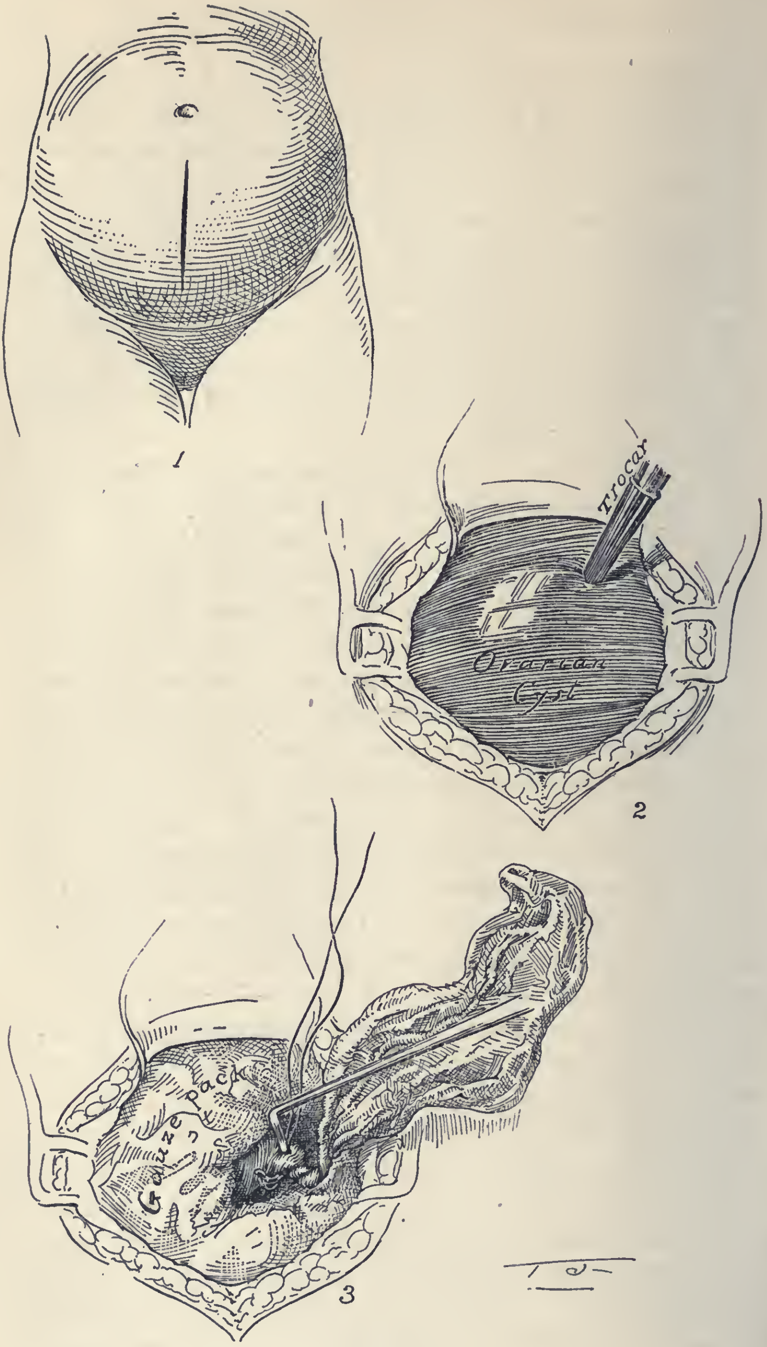

Fig. 459.

the end of the pedicle is cut through with the scissors. Two ligatures are now inserted with the ligature carrier, ligating from the center in both directions. I then release the stump from the clamp and the light catgut suture is run about the two ligatures, thus covering this raw stump with peritoneum.

Palpation and inspection of the pelvis show that the uterus, left tube, and ovary are atrophic and free. In closing the abdomen care is taken to evert the edges of the peritoneum which is sutured with a continuous, light iodin catgut. Three through-and-through interrupted retention sutures of heavy silk braid are placed through the rectus and fascia and skin from within outward on each side, each suture being supplied with two large sharp needles for this purpose, one on either end. The fascia is then closed with interrupted over-and-over catgut sutures. The skin is brought in coaptation with continuous interlocked black silk and the three retention sutures are tied not too tightly. The wound is now ready for postoperative dressing.

Pathologically this specimen is, as anticipated, a simple unilocular ovarian cystoma, containing one small inclusion cyst on its wall near the base. The tube which was removed with the tumor is adherent throughout its length.

CASE II.—The second patient is a young woman twenty years of age, who gives factory work as her occupation. She comes in complaining of pain in the lower abdomen. The history of this discomfort dates back one and a half years, at which time her husband, who is in the army, came home on furlough, whereupon she contracted a gonorrheal infection. Previous to that time she claims to have been well except that she makes the statement that in a general way since her labor three years ago she has felt that her uterus was not exactly right or as

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Fig. 459.—1, Incision in the anterior abdominal wall after intradermal infiltration with novocain. 2, Cyst exposed after retracting the abdominal wound and packing off the intestines with a gauze sponge. The trocar is introduced through the lower angle of the wound into the cyst. 3, The collapsed cyst hanging out of the wound shows the torsion of its pedicle. The ligature is being introduced just beneath this point of torsion.

normal as it was previous to labor. However, since this infection one and a half years ago the pain in the abdomen has been more or less constant and her menses have increased in amount. The pain is worse on the left side and is a constant dull ache, more severe when she is up and about than when she is quiet. In fact, it is so severe that she has not been able to work regularly. She states that she has one child three years old. Her pregnancy was normal and her labor a spontaneous one. She denies having had any miscarriages.

She began menstruating at sixteen and the periods were regular, coming on every twenty-eight days, lasting five or six days, and were free from pain until her labor three years ago. Since then she has had moderate pain with her periods. For the past one and a half years the periods have come every two to four weeks and have lasted from ten to fourteen days, being very profuse, with sharp, griping pains and blood-clots. Between these periods of bleeding she has suffered from a rather profuse vaginal discharge, one that requires the use of a napkin more or less constantly.

She states that she is moderately constipated and finds it necessary to take a laxative two or three times a week in order to move the bowels regularly. At the time she contracted the infection one and a half years ago she suffered from dysuria. For the past year or more, while there has been no pain on urination, she has noticed a moderate frequency of urination.

We find on inspection that this patient is a well-nourished, well-developed young woman who does not show the anemia which might be expected in one who has bled as profusely as she claims to have done. Her abdomen is well involuted, firm and elastic, but there is deep tenderness on both sides in the iliac region. Bimanual examination reveals a short, distensible, narrow vagina. The cervix is thick and swollen, pointing upward, and appears somewhat rough. There is a smooth grayish urethral discharge and a rather profuse vaginal discharge. The corpus is enlarged, boggy, retroverted, and fixed. The right appendage is prolapsed and thickened, but not particularly tender. The left pelvis is occupied by a tender circumscribed mass continuous with the uterus and extending down between the uterus and left pelvic wall into the pouch of Douglas.

Urinalysis shows no albumin or casts, but a small number of white cells are present. There is a leukocytosis of 6200 and hemoglobin of 85 per cent.

We have, then, in this patient a young woman who gives a definite history of an infection one and a half years ago, since which time she has had pain in the pelvis, her chief point of complaint. On examination we find retroversion of the uterus, prolapse of the appendages, with fixation and enlargement of the appendages, and a thickened, eroded cervix pointing upward and forward. We have, then, what is in all probability a case of bilateral pyosalpingitis, which, however, is not the complete diagnosis. We must think of these cases as representing a general pelvic peritonitis, which has existed in this case long enough to have positively acquired the additional term "chronic." This means more or less dense peritoneal adhesions together with displacement and fixation of the uterus.

As preparation for operating directly upon this pelvic condition by the abdominal route we will first prepare the uterus. The cervix is dilated with Hegar dilators; this is done gradually and carefully. Great haste should never be employed in dilating the cervix any more in gynecologic than in obstetric situations. This is particularly important in a cervix such as this, which is swollen and hypertrophic. This is done for the purpose of exploring the uterus in order to rule out the possibility of other factors of hemorrhage being present, such as mucous polyps, submucous fibroids, or other new growths. With the curet-forceps the uterus is shown to be free from such structures. In this case the curet is used simply to explore the uterus, as an instrument for palpation of the cavity, not for the purpose of scraping out the mucosa or any portion of it; that is to say, curetage of the uterus is not here indicated either on its own account or as preparation for further work in the pelvis by the abdominal route. It is sufficient to make a thorough application of iodin to the mucous membrane, a custom which I have followed for a long time. I use an applicator well saturated with iodin for the cervix and then a second one for the corpus. This cervix has gone through one labor and is swollen and eroded. Hence I shall now amputate it. Amputation of the cervix is a procedure that may be varied very considerably in its method of performance. In this particular case it would be entirely sufficient to make a low amputation. We divide amputations of the cervix into three groups—low, mid, and high. High amputation is for the cervix that is lacerated deeply into the vaginal fornices on one or both sides, and is everted and distinctly hypertrophic, the cervix found in women older than this patient, in the neighborhood of forty or fifty years of age; in other words, where there might be some reason for anticipating a future malignancy. A mid-amputation of the cervix is done when there are lacerations of a moderate degree. In this case, there being no extensive laceration, a low amputation will suffice.

Technically, this is done by grasping the anterior cervical lip with a volsellum forceps and the posterior lip with a second forceps, so that the two lips are held apart. The cervix is then split laterally not more than ½ inch with the scissors. With a sharp knife an incision is made from within the cervical canal, slightly curved and running backward until with the finger the point of the knife can be felt directly beneath the vaginal mucosa. This is not cut through. The outer mucous membrane is then incised on a plane below that of the incision going through the cervical wall, and the portion of the mucosa projecting over the angle of this incision is reflected upward. This permits the anterior cervical lip to be cut away. With chromic catgut we now stitch this reflected portion of the vaginal mucosa down over the cervical wall, bringing this exactly to the edge of the cervical canal. The reason that this method of amputating the lip of the cervix is employed is to avoid a band of scar tissue in the cervical wall which results from the Schroeder or Emmett amputations. In this case there will be no line of scar tissue in the cervical wall, the scar tissue being where it is best taken care of, *i. e.*, between the vaginal mucosa and the cervical wall. This edge of mucous membrane is sutured over the cervical stump by two or three, usually two, over-and-over interrupted chromic catgut sutures. These are not cut, but are held by a clamp, to be used as a tractor. The posterior lip is now amputated in the same way and the vaginal mucosa is drawn over its raw edge exactly as before. This leaves two small angles at the side, each one of which requires an over-and-over catgut suture. These are cut short. A small gauze roller is now inserted through the cervical canal into the uterus, not packed in tight and not used as a tampon, but merely as a surgical dressing for the new cervical lips. The sutures in the clamps which were used as tractors are now cut and the cervix is allowed to fall back into the vagina. In this particular case there is no relaxation of the vaginal wall and no perineorrhaphy will be necessary. This piece of gauze in the cervix is long enough so that it can be packed down lightly into the vagina. It is cut off at the vaginal introitus and will be removed in twenty-four hours.

The abdominal incision in this case is made very much as in the previous operation, that is to say, the skin is incised and the skin and subcutaneous fat and fascia then dissected free. The recti are then dissected from their sheaths through the entire length of the wound. The patient is now tipped into the Trendelenburg position. The peritoneum is opened and the self-retaining retractors are placed in position. With the patient in this position it is at once evident that the pelvis is in about the condition anticipated from our bimanual examination (Fig. 460). The first thing that presents itself is a cyst-like mass about the size of a lemon, about which we see nothing more than an adherent coil of intestines, so that the uterus, tubes, and ovaries are all buried beneath the adhesions which run upward as high as the sigmoid flexure. The omentum is adherent to this mass on the left side, presumably where the left uterine horn should be found. This is freed and a laparotomy pack is introduced in order to pack off the free coils of the ileum and the omentum. This cystic mass does not apparently represent any organic structure in which we are interested, but seems to be simply an inclusion cyst such as we occasionally find in these cases of general pelvic peritonitis. This one appears to be formed in the adhesions over the right tube, and a smaller cyst, the size of an English walnut, is found below, attached to the fundus of the uterus. It is immaterial whether, in breaking up the adhesions and enucleating the tissues, these cysts are ruptured or not, as they contain clear serum. They are usually thin walled and very easily broken. Occasionally, however, they are abscesses. On the left

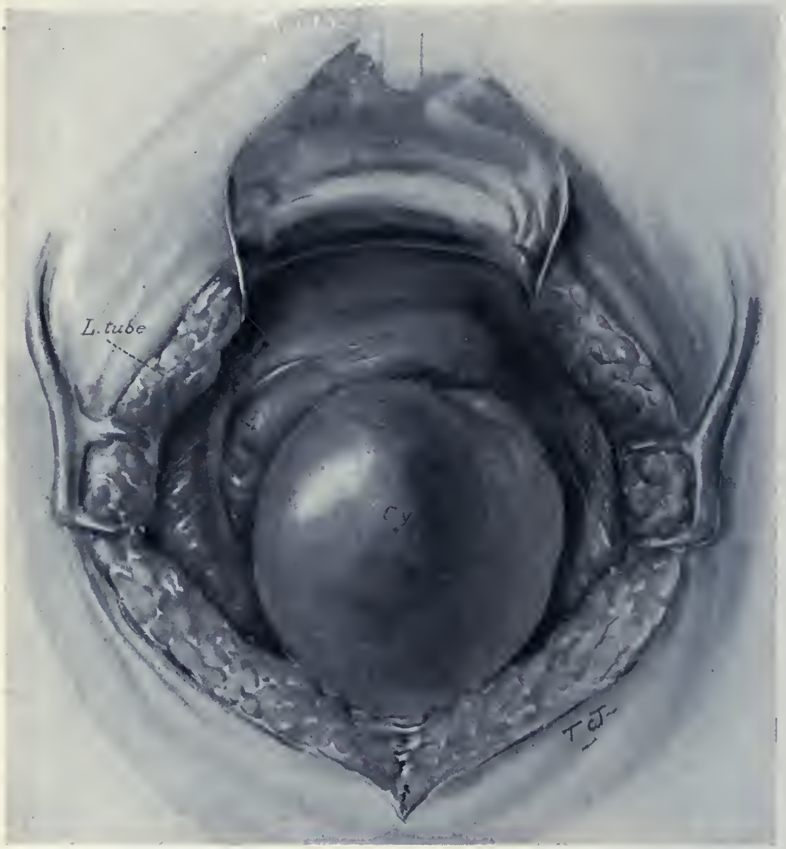

Fig. 460.—Abdomen open, and the omentum, freed from the left side of the pelvis, is packed off with the free intestines. This reveals a peritoneal cyst attached to the right tube and pelvic wall beneath which the retroflexed uterus and tubal abscesses are buried in adhesions. The upper portion of the kinked left tube is seen just to the left of the cyst.

side the adhesions are somewhat lighter and more easily separated. The left tube, I find, has the end clubbed, is thickened, and with the left ovary is bound to the broad ligament. I am freeing this mass from its depth in the pelvis and this makes it possible to identify the fundus of the uterus. The uterus is seen to be enlarged, soft, and boggy, and is rather densely adherent in retroposition to the rectum. The bladder, fortunately, is free, so that the anterior culdesac is not involved in the peritonitis. The right tube is in most respects similar to the left except that it is not so markedly enlarged. The left tube is soft and fluctuant and undoubtedly contains pus. The right tube is firm and hard. Neither of these tubes is ruptured and, therefore, no pus has escaped. Both ovaries are moderately cystic. There is considerable infiltration in both round ligaments and broad ligaments on each side. Inasmuch as the ovaries are so readily freed, we can detach the mass without tearing them particularly, and as they are merely moderately cystic and do not contain abscesses and are not continuous with the tubular abscesses, it would be best to preserve both of them, particularly in a patient of this age.

This case is in many respects characteristic of many of the young women we have in the Cook County Hospital suffering from bilateral salpingitis. The great majority of them are women of the pus-tube age, which in my service in this hospital is from fifteen to twenty-five years. The majority of them come in, as this patient, after some years or months of illness, that is to say, they are nearly all chronic. They may come in with fever and chills and an acute exacerbation, but this occurs in only a relatively small proportion. In my opinion it is extremely desirable to preserve in these young women the function of menstruation. There are many who object to leaving even a portion of the uterus. There are others who argue for a partial extirpation of this structure. It is particularly desirable that these young women should have that function preserved where it is possible to preserve the ovarian tissue. For that reason I shall undertake a procedure which I have used in a very considerable number of cases.

We shall in this case leave the ovaries *in situ*. I start the enucleation by placing ligatures between the tubes and ovaries. I ligate on the left side first. As the ligatures are placed and the tissues are incised, the tube is cut free as far as its attachment to the uterine horn. I then ligate and free the left round ligament. This is done for a purpose which I shall demonstrate later. Another ligature is then placed through the broad ligament and tied in the angle of excision. It is not low enough at any time to ligate the uterine artery. The right tube is now freed in precisely the same manner and the right round ligament is separated from its uterine attachment as was the left. This leaves us with the fundus of the uterus and both tubes quite free. And now by a slightly curved incision, from below upward and somewhat oblique, I cut through the anterior uterine wall well below the fundus. The anterior wall of the uterus is grasped below this incision with volsellum forceps for the purpose of holding it upright. The posterior wall is then cut through in the same way. This is nothing more or less than the removal of the entire fundus of the uterus with the two tubes (Fig. 461). The exposed ring of mucosa is now touched with a white-heat cautery. The uterine cavity is not cauterized, but merely this exposed edge. The mucosa is seen to be thickened and somewhat hyperplastic, a condition of hyperplasia that is rather frequent in chronic metritis. The wall of the uterus is also somewhat thickened and soft.

The two uterine walls are now brought together with iodized catgut. The suture begins on the left side and runs across to the right, the first row of sutures taking in the uterine wall, but not going through the uterine mucosa. Then coming back from the right side I bring the anterior and posterior edges of the uterine walls together (Fig. 462). This is done rapidly without any attempt at peritonization, because it is to be entirely covered over in the next procedure. With the uterine stump still in the grasp of the volsellum forceps, the left round ligament is now picked up by the needle and sutured to the opposite horn of the uterine stump, a little posteriorly to the suture that has just been introduced. The right round ligament is now sutured to the

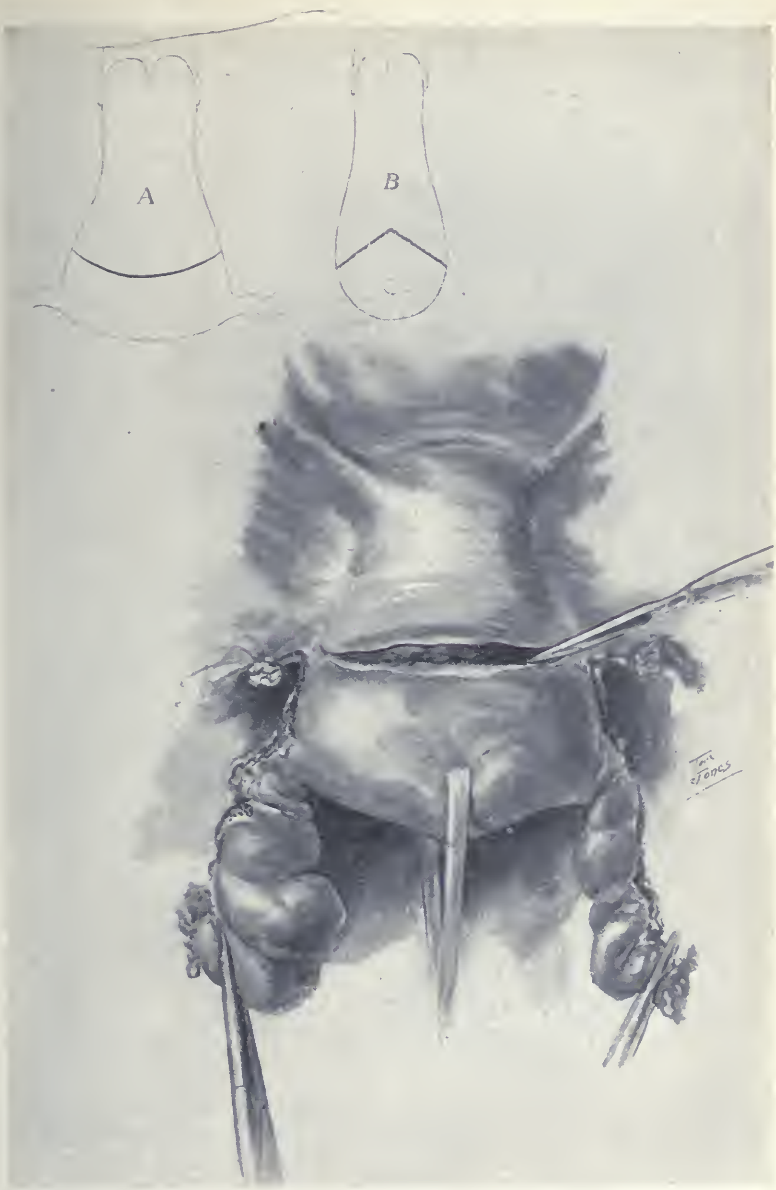

Fig. 461.—The tube masses have been freed and are held up with the fundus of the uterus from which the right ligaments have been ligated away. The fundus of the uterus is being amputated. *A*, The line of amputation—anterior and posterior wall. *B*, Line of amputation from a lateral aspect.

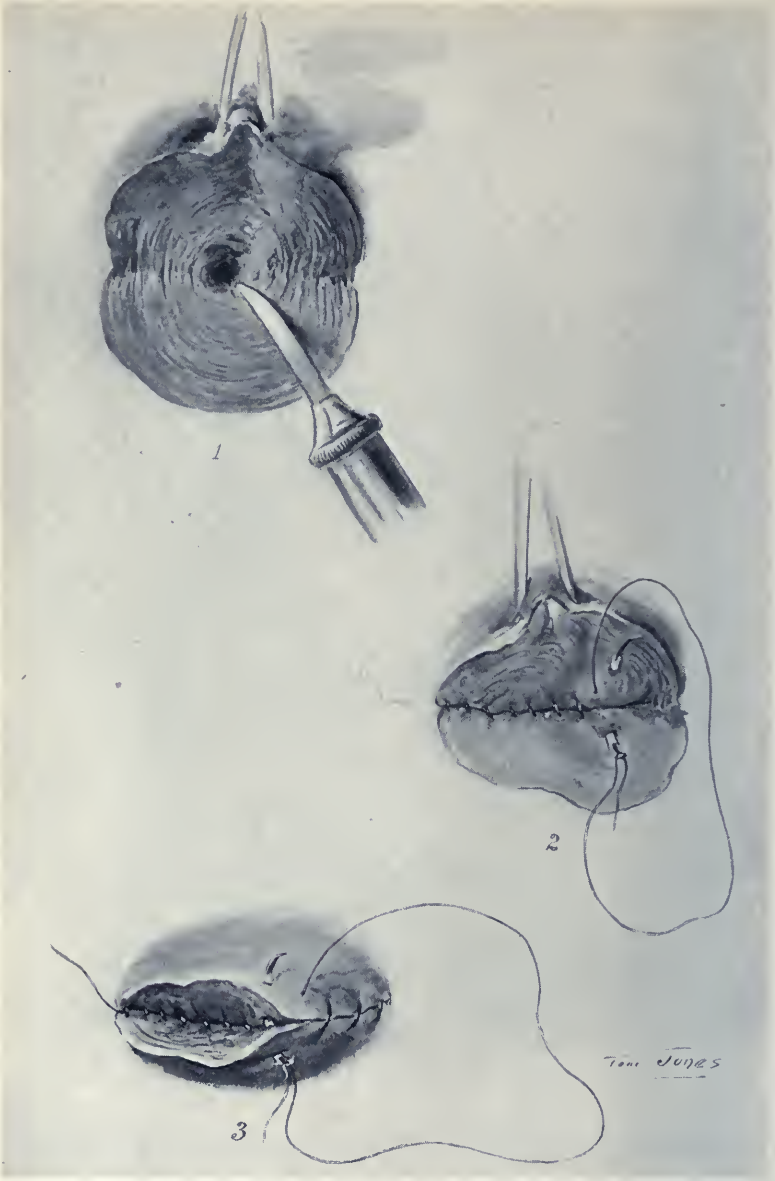

Fig. 462.—1, The exposed mucosa is lightly seared with the cautery directly after the fundus of the uterus has been amputated. 2, The first line of sutures in bringing the uterine walls together anteroposteriorally. This passes through the musculature only. 3, A continuation of the preceding suture, carrying the line back and bringing the edges of the uterine walls together.

left edge of the uterine stump. It is now possible with a continuous catgut suture to bring the round ligaments together over the uterine stump. The broad ligaments are picked up from beneath the round ligaments and brought together from side to side with two or three stitches, completing the peritonization anteriorly. It is now evident that the anterior culdesac is perfectly free and clean. Going again to the posterior wall, the broad ligaments are brought together from side to side, the suture going into the posterior uterine wall or not, as the case

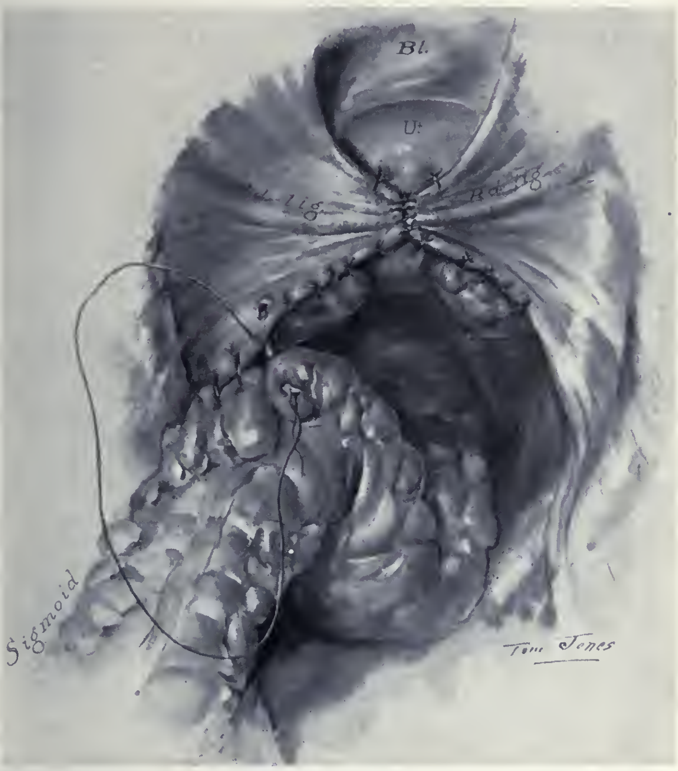

Fig. 463.—The stump of the uterus has been covered by the round and broad ligaments anteriorly and posteriorly in part. The ovaries have been suspended to the broad ligaments. The sigmoid flexure is being stitched by its appendices to the broad ligament commencing at its peritoneal reflection on the left side.

may be, for the purpose not only of covering over this raw uterine wall which was adherent to the rectum, but also for the purpose of bringing into suspension the two ovaries which we have left attached to their respective infundibulopelvic ligaments (Fig. 463). I will now puncture with the cautery the small cystic areas which are present in both these ovaries, and as I do so I feel the ovary collapse and become much softer between my fingers. It is usually sufficient to puncture one of these cysts with a cautery, and from that point of puncture the cautery can be introduced into such other cysts as may be present. We now have the uterine stump covered entirely by the round and broad ligaments and with the anterior culdesac clean. The sigmoid flexure was, as I said, adherent to the right tube on its under surface. When this was freed it left the sigmoid flexure somewhat raw at its point of adhesion. The sigmoid is now allowed to fall into its normal position and it is seen to cover over the posterior culdesac. To leave this space open would be dangerous because of the possibility of various structures becoming adherent in it. The ones most likely to become adherent would be the ileum first, the sigmoid flexure second, and third the omentum. The danger of such adhesion would be the possibility of intestinal obstruction, partial or complete, as a postoperative complication. Hence, it is desirable to seal off this raw posterior culdesac from the rest of the abdominal cavity. Possibly, if we closed the wound now and left the sigmoid flexure in position, it would become adherent, thus closing over the culdesac in a relatively natural way. I intend, however, to bring the sigmoid flexure into positive adhesion in this position by lightly stitching it with an iodized catgut suture, beginning at the point on the left side where it is reflected from the pelvic wall. This running catgut suture is introduced through the pelvic peritoneum, then catching the fatty edges of the appendices epiploicæ of the sigmoid flexure on this lower side. In order to come out on the right side of the pelvis, leaving the sigmoid flexure in its proper attitude, it is necessary to cross over, so in the median line I take one stitch directly into the gut wall and then cross over to the upper side of the sigmoid, producing not more than one half-rotation and going forward constantly as I go across. On the right side it is not necessary in this particular case to go as far up on the pelvic wall or as far forward to the round ligament as it was on the left side, because the right pelvic wall was not so involved as was the left. Therefore as soon as I reach the right broad ligament I can drop below, arriving very soon at the right infundibulopelvic ligament. From this point on the line of suture goes almost straight down the pelvic wall. It goes across the right posterior peritoneal covering of the pelvis until we arrive at the reflection of the rectum from the peritoneum close to the promontory of the sacrum where the suture stops. It is necessary in this method of sigmoid flexure

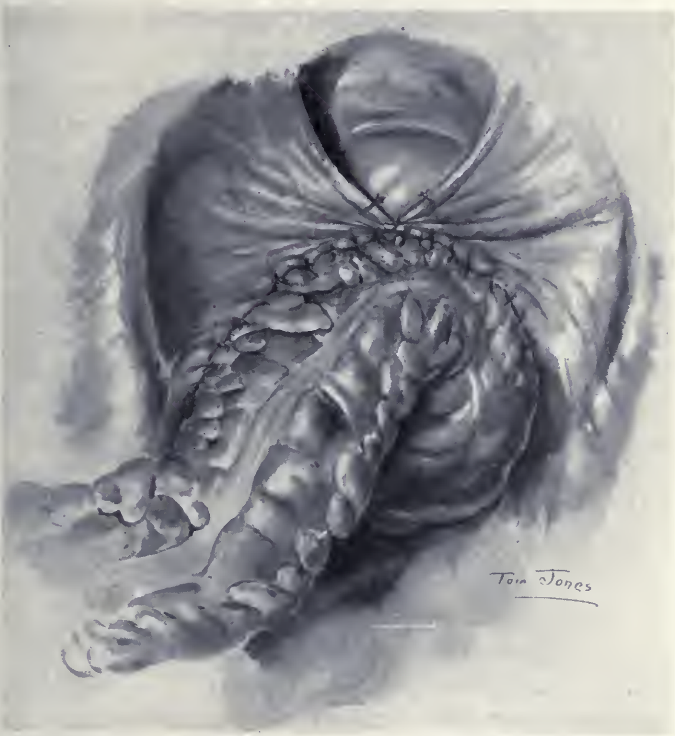

Fig. 464.—The sigmoid flexure peritonization is shown completed, thus blocking off the culdesac from the posterior peritoneal cavity.

peritonization to carry your suture around that far, otherwise there will be left a hole through which the intestine might prolapse and become adherent in the culdesac. This, as you see, produces a perfectly clean posterior surface and closes over the posterior culdesac entirely. This completes the peritonization of the pelvis (Fig. 464).

To take up certain technical features of this operation, I desire to enlarge upon this method of handling the fundus of the uterus. As you see, while the uterus has been reduced about half in size, merely the fundus has been cut away, that is to say, not more than a third of its menstruating capacity is destroyed. This will make it possible for this patient to continue menstruation. She will not menstruate profusely probably, but she will menstruate regularly; enough to satisfy her idea of the normal condition. This procedure of removing the fundus of the uterus together with the tubes is not a new one. It has been done for some time by various surgeons. Many men at various times have attempted to save some portion of the uterus and ovaries for the purpose of preserving menstruation in these young people. Where the ovarian tissue can be preserved it should be done. Buettner, of Geneva, has described an operation which he calls defundation of the uterus. More recently Blair Bell, of England, described an operation done in almost an identical manner which he called acrohysterectomy, meaning hysterectomy involving merely the top or fundus of the uterus. As I said before, I have used this method in operating for this condition in these young people for the last six years. Many of these patients have come under my observation subsequently and the surprising thing is that the uterus or portion which was left is so freely movable. Far from being fixed and far from falling back into displacement, it remains upright and mobile.

The second feature which I wish to speak of especially is the use of the sigmoid flexure in peritonization. This is the method which has been used in Chicago, chiefly by Webster, for fifteen years, perhaps longer. Webster has not applied it as I have today. He reserves it for peritonization of the pelvis where he has done a subtotal or total hysterectomy. It may also be used to cover in a portion of the lower pelvis. Occasionally the anterior culdesac is not free or the bladder is involved in the tide of peritonitis, and the sigmoid can then be brought over as extensively as may be desired. Other surgeons have more recently made use of this method of peritonization, Buettner having again described a series of procedures by which the sigmoid flexure is used for pelvic peritonization. The most desirable factor in this procedure is the fact that it can be adapted to so many different degrees of peritonitis in the pelvis. It may be used, for instance, in peritonizing merely one side or the other where both sides are not involved. Occasionally it is not necessary to close off more than the lower portion of the culdesac, so that it need not include anything above the uterosacral ligaments. So far as I know, no operators, however, have employed the method in connection with defundation of the uterus, that is to say, where enough of the uterus has been left to preserve subsequent menstruation. In my own personal experience it has been an extremely satisfactory method of closing off the raw pelvis from the abdominal cavity.

CLINIC OF DR. EDWARD LYMAN CORNELL

Chicago Lying-in Hospital

DEMONSTRATION OF OBSTETRIC CASES WITH DISCUSSION OF POINTS IN TECHNIC

Summary: A case of puerperal toxemia and insanity—induction of labor; spinal puncture for uremic convulsions; scopolamin and morphin in the first stage of labor—indications—contraindicated in premature cases—technic of its use—three illustrative cases. The heart tones in labor—a new stethoscope permitting physician to listen to heart tones without unsterilizing his hands. Method of insuring proper identification of babies in the Chicago Lying-in Hospital.

This patient, aged twenty-six years, para I, was admitted to hospital on the service of Dr. Beilstein March 12, 1919.

The family history presents no facts of present interest, and her past history is only of interest in that she had frequent attacks of sore throat up to one year ago, when she had her tonsils removed; she has also had several abscessed teeth extracted.

Menstrual History.—First menstruation at fifteen years, twenty-eight-day type; duration three to four days; moderate amount; no pain until about nineteen years of age, when pain during the first day developed. This is her first pregnancy; no miscarriages.

Present Trouble.—First day of last period was June 10, 1918. Morning vomiting appeared in August, 1918. Vomiting rather severe, and lasted, with a few intermissions, throughout pregnancy and up to two weeks ago.

Two weeks ago she began to notice swelling of hands and legs in the morning. Swelling of legs grew worse and persisted all day, while hands became better. One week ago she noticed a marked swelling of vulva and labia, which came on in a very few minutes. The patient was unable to be up and around or to keep thighs together. She had some occasional headache in the weeks first preceding the swelling.

She came to the hospital seeking relief for the distressing vulvar swelling, as she was unable to sleep because of the uncomfortable position it was necessary to assume.

Physical Examination.—The chest and heart were negative. The face was red and mottled. There was marked edema of the lower extremities and enormous edema of the vulva. The tissues of the vulva were so distended that they looked transparent and made impossible adduction of the thighs.

Blood-pressure: 170 systolic and 100 diastolic.

Urinalysis showed 4 + albumin, hyaline and granular casts, but no blood.

March 14th the patient was taken to birth-room and the labia and adjoining tissues were punctured and about 1 pint of serum removed. The openings continued to drain for thirty-six hours. On March 16th she was examined vaginally by me at 11 A. M. It was my intention to induce labor. I found the cervix effaced and 3 cm. dilatation. A large Voorhees bag was introduced after the bag of waters was ruptured. No traction was applied. Pains began at once. They varied from ten minutes apart at first to two to three minutes apart during the afternoon. At 5 P. M. the bag was found out of cervix and removed from vagina by moderate traction. The baby was born at 5.57 P. M. It weighed 5 pounds, 12½ ounces. There was no postpartum hemorrhage or perineal tear.

After the delivery, which was comparatively easily accomplished, the patient felt much better. She slept well that night and passed urine freely. The lochia was normal and had no odor. The bowels moved well. On March 15th the edema was less and the patient felt comfortable. On March 16th her condition was the same.

On March 17th at 11 P. M. the patient began to complain of headache and dimness of vision. She vomited coffee-ground material. She was very restless and wildly delirious. The blood-pressure was 178 systolic and 120 diastolic. At 10 A. M. the following day (March 18th) convulsions began. The second one occurred in twenty minutes. At 11 A. M. a venesection was done by Dr. DeLee and 750 c.c. removed. At 11.15 A. M. I made a spinal puncture, removing 10 c.c. of bloody spinal fluid. There was no increased intraspinal pressure. The patient was very restless, delirious, and hard to restrain.

In all she had six convulsions, four before the bleeding and spinal puncture and two after. The convulsions were controlled by the use of $\frac{1}{4}$-gr. doses of morphin every two hours for three doses. The patient was more or less unconscious until March 21st, at which time she recognized her surroundings and said that she felt very comfortable. On the same day it was noted that the edema had markedly decreased. She had been kept on a water diet for forty-eight hours and had been given 60 grains of potassium bromid every six hours. On March 22d hallucinations appeared, the patient thinking her mother was dead and that there were voices in the room. She got out of bed to answer the telephone, saying that her sister was calling her. On the 23d, 24th, and 25th she was very restless, screaming at times, and endeavoring to call her sister and husband into the room. She slept about two hours daily. During the time she was not screaming she was muttering and talking incoherently.

On March 25th she woke up between 3 and 6 P. M. and was perfectly rational. She remembered all the facts in detail up to the time she had convulsions. She could not tell very clearly what had happened since, although she knew she was acting queerly, but she could not control herself. One of the peculiarities of puerperal insanity is that most of the women seem to remember the things that occurred, but they do not have control over their actions.

From the 25th of March on the patient rapidly recovered. She never lost consciousness. Her blood-pressure came down to 140 systolic and 85 diastolic.

Note.—This patient was discharged from the hospital on April 9th. The urine still showed albumin and hyaline casts. There was no edema and vision was normal. The baby is living and well.

These cases of severe toxemia need careful attention. It is not necessary to fill them with medicines. It is our custom to empty the uterus as early as possible in the most feasible way.

In a few cases we have done cesarean sections, but usually, if time is not a factor, the induction of labor is resorted to. Some consideration should be paid to the fetus. In many of these cases the baby is very toxic and a long labor is almost certain to injure the child fatally. In old primipara who have little chance for a second child it is usually unwise to resort to induction because of its bad effect on both mother and child.

In 3 cases I have tried spinal puncture to control the convulsions. In one it worked as if by magic. The patient was extremely restless. In fifteen minutes she was sleeping calmly. The fluid in her case was under considerable pressure. In the second case it had no effect, although the fluid was under pressure. In this case it had no effect. Reports in the literature are favorable however.

It is not unusual for convulsions to appear after two or three days as in this case. Insanity may also supervene. It is unusual, however, for the insanity to clear up so readily. How to explain this is difficult.

THE USE OF SCOPOLAMIN AND MORPHIN IN THE FIRST STAGE OF LABOR

The use of scopolamin and morphin in the first stage of labor has been practised here for several years. In selected cases it does nicely. There should be no indication present in either mother or child for rapid delivery. The pelvis and fetus should be normal in size, shape, and no tumors present. In premature cases it is contraindicated.

We have been using it in primipara where the pains are well established and in those who complain of severe backache. It is here that scopolamin has its greatest usefulness. Shortly after it is administered the patient falls into a sleepy stupor, to be aroused with the labor pain, but the "edge" is taken away.

Another feature to be noted is the rapid dilatation of the cervix which frequently follows its administration. A thick cervix will frequently dilate completely from 2 cm. in three-quarters of an hour.

The patients do not seem to possess the ability to bear down in the last of the second stage. They make the attempt, but most of them complain that they cannot hold the breath long enough. It does not seem to make any difference how long previously they have had the last dose of scopolamin. A deep episiotomy overcomes the perineal obstruction.

The method of administration is briefly as follows: Morphin, gr. $\frac{1}{6}$, with scopolamin, gr. $\frac{1}{150}$ to $\frac{1}{100}$, is given hypodermically at one dose. In forty-five minutes to two hours the scopolamin is repeated. At most, four doses are given. Before each dose a rectal examination is made to determine the amount of dilatation present in the cervix. If it is complete, or nearly so, no more is administered. The morphin is not repeated. Lately I have been using the technic as outlined by Schwarz, of St. Louis. It is too early for me to comment on his method.

For many years members of the staff have been using potassium bromid, gr. xl, and chloral hydrate, gr. xv, per rectum for the purpose of relieving the pain during the period of dilatation of the cervix. Doctors DeLee, Stowe, and Lapham have claimed great success in many cases.

During the last of the second stage we administer ether during the pain. This makes the labor practically painless, or at least makes it much easier to bear.

I wish to call your attention to 3 cases recently delivered in which this method was employed.

Case I.—Number 6514, admitted March 21, 1919, at 11.40 P. M. Age twenty-three; para I.

The patient had been well up to three years ago, when she developed pain in the head. During pregnancy she has had much pain in the chest and abdomen, so much so that during October and November, 1918, she had to stay in bed. I did not see the patient until she entered the hospital in labor. Labor began March 21st at 1.30 P. M. Diagnosis on entrance was R. O. A. External pelvic measurements were spines 26, crests 28, bitrochanteric 32, and Baudelocque 20.

Urinalysis showed a trace of albumin; no casts.

The pains on entrance were three to five minutes apart. On rectal examination the cervix was effaced with 2 cm. dilatation. The pains gradually grew stronger and more regular until 6 A. M., when they were every five minutes and fairly severe. Examination at that time still showed the cervix to be effaced, rather thick, with 2 cm. dilatation.

At 8.30 A. M. she was given $\frac{1}{6}$ gr. of morphin and $\frac{1}{150}$ gr. of scopolamin. At 9.30 A. M. she was given $\frac{1}{150}$ gr. of scopolamin. At that time rectal examination showed 3 cm. dilatation. The head was engaged.

At 10.30 A. M. she was given $\frac{1}{200}$ gr. of scopolamin. Examination at that time showed the cervix to be effaced and $3\frac{1}{2}$ cm. dilatation. Rectal examination at 11 A. M. showed 9 cm. dilatation. Previous to the use of morphin and scopolamin the patient complained of severe pain in the back. Muscle coordination was lost after the third dose of scopolamin. The bearing-down pains began at 11.30 A. M., when the bag of waters ruptured. Episiotomy was performed at 12.10 P. M., and as the patient did not bear down sufficiently, 3 minims of pituitrin were given at 12.17 P. M. At 12.21 P. M., after two rather severe pains, the baby was born; $\frac{1}{2}$ ounce of ether was given during the last few pains. Baby weighed 6 pounds, 15 ounces, cried lustily, and showed no signs of asphyxiation.

On questioning this patient the day after delivery it was noted that she had a very hazy remembrance of the exact things that happened to her after the second dose of scopolamin. It is possible in these cases to reconstruct the whole process if the physician asks the patient leading questions. If, on the other hand, you ask them what has happened during the labor, they will say possibly that they remember the cutting of the perineum or remember that you insisted upon their bearing down. They seem to feel that it is impossible for them to bear down because of the air-hunger.

Case II.—No. 6500. Age thirty-one; para I. Patient entered hospital March 19, 1919, at 7.25 A. M. She had no pains, but a slight bloody discharge. The pelvic measurements were spines 28, crests 30, bitrochanteric 33, Baudelocque 18, conjugata diagonalis 11. The last menstrual period was June 14th, with quickening November 2, 1918.

She felt fine all the time until she took sick with influenza and pneumonia in October. She made a good recovery, although she was in bed two weeks, up one day, and then returned to bed for a few days more. In December she vomited only once. In January vomited about five times, usually around midnight. She was perfectly well until a week ago, when she developed a backache. This morning at 4 A. M. she got up to spray her throat for a little soreness and at the same time noticed a slight bloody mucous discharge. She was advised to come to the hospital. She has had pains in the back since 7 A. M., which came six to eight minutes apart.

At 10.30 P. M. patient went into active labor. The diagnosis was R. O. A. The bag of waters was intact and there was a slight bloody mucous discharge. Rectal examination at 3 A. M. showed 3½ cm. dilatation; fetal heart tones 140. At 6.30 A. M. the dilatation was the same and the heart tones 152. At 8.30 A. M. 3½ cm. dilatation and heart tones 140.

At 10.50 A. M. $\frac{1}{6}$ gr. of morphin and $\frac{1}{100}$ gr. of scopolamin were given. At 11 A. M. $\frac{1}{300}$ gr. of scopolamin was given and at 11.55 A. M. $\frac{1}{300}$ gr. was given.

Patient had been complaining continuously of severe backache and severe pains. Bag of waters and head were in close proximity. On rectal examination it was noted that the bag of waters appeared to be very thick.

At 4 P. M. cervix was found effaced and 3½ cm. dilatation. At 5.20 P. M. cervix was completely dilated and head deep in the perineum.

During the afternoon the pains were slight and far apart. Within one hour and twenty minutes complete dilatation took place. The patient made but very little complaint. Muscle co-ordination was lost after the third dose of scopolamin.

Episiotomy was done on the right side and 1 ounce of ether was given during the last stage. The baby weighed 8¼ pounds and cried vigorously. Its temperature was 100.4° F. There were no signs of asphyxiation. On examination, the placenta showed that it had been located deep in the uterus and the membranes had ruptured at the margin close to Waldeyer's ring.

Case III.—Number 6468. Age twenty-six; para I. This patient had scarlet fever as a child; tonsillectomy at fourteen; influenza and pneumonia in December, 1918; no miscarriages.

The patient entered the hospital at 4 A. M. March 18, 1919, having slight pains and a bloody discharge. Diagnosis was L. O. T. The bag of waters ruptured spontaneously at 2 A. M. with no pain. Rectal examination at 1.30 A. M. showed cervix not entirely effaced, with 2 cm. dilatation. The pains began at 5 A. M. and were three to five minutes apart.

At 2 P. M. patient was given $\frac{1}{200}$ gr. of scopolamin and $\frac{1}{6}$ gr. of morphin hypodermically. The pains were quite severe, three minutes apart, and lasting one minute. At 3 P. M. the cervix was effaced, 3 cm. dilatation, with engagement complete. At 3 P. M. $\frac{1}{200}$ gr. of scopolamin was given. At 3.45 P. M. rectal examination showed 6 cm. dilatation and engagement complete. At 3.55 P. M. $\frac{1}{300}$ grain of scopolamin was given. At 4.30 P. M. the cervix was effaced, 9 cm. dilatation, and head in transverse diameter. Dilatation was quite rapid from then on. At 5.45 P. M. dilatation was complete, with head deeply engaged. The patient made little complaint; the pains had been regular and firm.

At 7.20 P. M. episiotomy was done and 1 ounce of ether given. The baby was born at 7.28 P. M., male, weighing 7 pounds, $\frac{1}{2}$ ounce. It was rather weak and somewhat asphyxiated. It soon cried and in five minutes acted normally. This patient stated the next day that she could remember myself and the intern talking to her, but that the pain was not severe. She did not remember the actual birth of the child.

THE HEAD STETHOSCOPE

In connection with the work at the Chicago Lying-in Hospital I want to call your attention to a couple of points in our technic which we have found most valuable. One is the use of the head stethoscope, and the other is the method of identification which we employ.

We insist upon the intern watching the heart tones very closely during the course of the labor. The condition of the fetus during labor is of the utmost importance. Many physicians neglect this point. In fact, it is not uncommon for us to educate men who have been out in practice many years in the art of distinguishing the fetal heart tones from other sounds in the abdomen. Many still-births could be avoided if more attention were paid to the condition of the fetus.

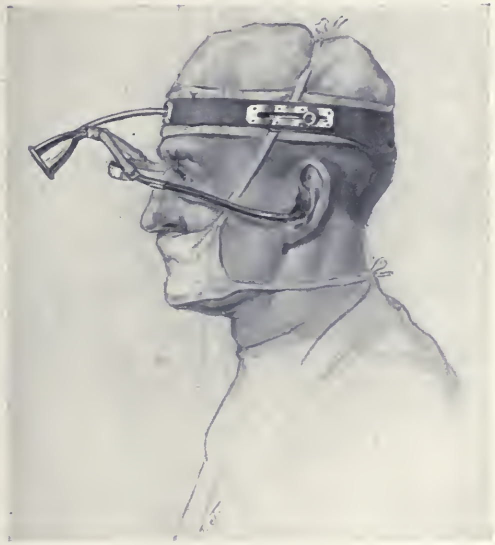

Fig. 465.—Head stethoscope for the safe and convenient observation of the fetal heart tones during labor.

For operative cases, such as low forceps, version, extraction, etc., we have developed a head stethoscope. The idea was first suggested by Dr. D. S. Hillis and improved upon by Dr. DeLee and other members of the staff, so that at the present time we have this instrument. This stethoscope is worn on the head (Fig. 465). It leaves both hands free for any operative work you may wish to do. It is a very simple matter to lift the sterile towels from the abdomen and place the head stethoscope against it in order to hear the heart tones. We believe that this instrument has been the means of saving many babies. It also permits us to do a forceps case more slowly, as we are sure of the condition of the baby throughout the manipulations.

MEANS OF IDENTIFICATION FOR BABIES

We use three means of identification for the babies in order to prevent any possibility of their being mixed. Immediately after the birth of the child a wristlet is put on the baby and a corresponding one on the mother, each marked with a similar number. These wristlets are sterile. They are included in each labor drum. We number them from 1 to 250 in rotation. By the time the last number is used the earlier cases have left the institution, so there is no chance of duplicating.

Then a piece of adhesive tape on which is written the baby's name and number, the date of its birth, its sex, and the attending physician's name, is placed on the baby's back before it leaves the delivery room. They are marked as follows:

Baby ....
....
Date .... *Sex* ....
Dr. .... *No*.. ....

Before leaving the delivery room footprints are taken. Two copies are made, one of which is attached to the history sheet and the other given to the mother.

In a large institution such as this all these precautions are necessary, as it is easily possible to interchange babies, especially if several women deliver at the same time. With these checks there is little chance of mixing the babies.

CLINIC OF DR. BENJAMIN F. DAVIS

PRESBYTERIAN HOSPITAL

FRACTURE OF THE OS CALCIS

Summary: Examination of patient—detailed diagnosis; causes of disability following fracture of the os calcis as guides in treatment; mechanism of fracture—classification.

THIS patient is forty-one years of age. He was brought to the hospital about twelve weeks ago to be treated for the injuries resulting from an accident. His story was as follows:

While at work near one of the pits for the counter-weights in the new Franklin Street bridge the patient stumbled over a rope and plunged into the pit; he fell a distance of 45 feet, alighting on his feet on the concrete flooring. He was brought to the surface with but little delay, and arrived at the hospital about an hour after the accident. I saw the patient about an hour later. Except for a marked ecchymosis on the right arm, the surgical pathology was confined to the feet. On inspection, both feet were seen to be markedly flattened and mushroomed out. The left heel appeared to be about half its normal height, and was considerably broader than the region of the malleoli just above. The skin did not appear to be injured. On palpation, numerous freely movable bone fragments could be distinguished, and the entire heel could be molded much like a bag of beans. The right foot presented quite a different picture. The plantar surface was quite convex, the apex of the convexity being just back of the middle of the foot and the sole of the foot was a broad oval in outline. The skin of the plantar convexity was definitely ischemic over an area nearly circular in form and about 3 inches in diameter. The calcaneus could be palpated posteriorly, but further forward it became lost to the examining fingers in a mass of other bone which, laterally, seemed continuous with the external malleolus displaced to the sole of the foot, and medially, with a mass which could not be identified but seemed to lie to the inner side of the internal malleolus. The fragments were so jammed together in this foot that no crepitus was felt on gentle manipulation.

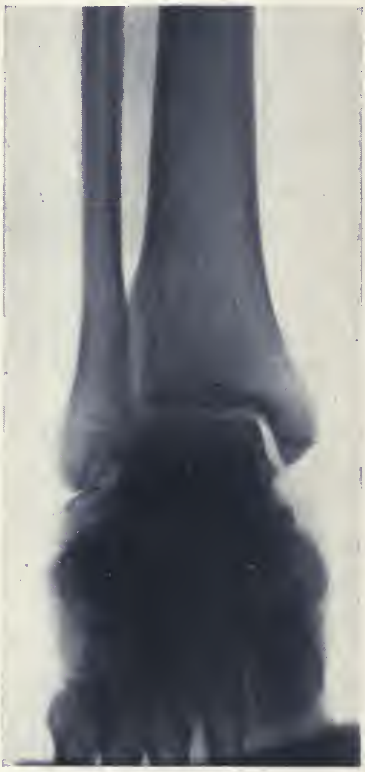

Fig. 466.—Roentgenogram of left foot, coronal plane. Note (1) that the tibio-astragaloid joint is intact; (2) a displaced fragment from external plate of calcaneus is in close proximity to tip of external malleolus—one of the common causes of disability following fracture of the os calcis.

x-Ray pictures of the left foot showed what we might term total comminution of the left calcaneus, apparently without associated injury of other bones (Figs. 466, 467). I cannot show you an *x*-ray of the right foot which will disclose anything; this patient was shown in clinic a number of times by members of the Hospital Staff and during one of the trips from the *x*-ray room to the clinic the plates of the right foot—the plates everyone

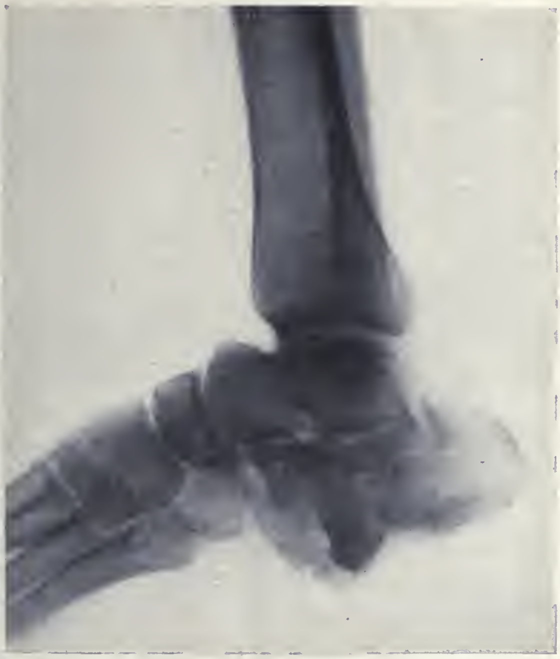

Fig. 467.—Roentgenogram of left foot, sagittal plane. There are at least five important facts illustrated by this roentgenogram. In the first place we see that the astragalus is intact, and, therefore, the tibio-astragaloid joint is also intact; there are many lines of fracture in the calcaneus, but the larger ones seem to radiate from a point on the dorsum of the bone beneath the convex articular facet of the astragalus and in direct line with the tibia—the starting-point for many fractures of the calcaneus; the lines of fracture involve the dorsal articular facets of the astragalus, thus including the sub-astragaloid joint in the fracture—a second common cause of disability; several bone fragments project into the sole of the foot; if these are allowed to remain in their present position they will be a cause of permanent disability; lastly, note that the posterior two-thirds of the calcaneus tilts backward and upward, thus decreasing the height of the heel and lowering the arch of the foot. If this is uncorrected it may be a cause of pain in the sole of the foot, and, if associated with eversion of the bone, a very potent cause of flat-foot.

was most solicitous about—were broken. I think I can describe them fairly accurately. The plate of the lateral view showed that the anterior third of the calcaneus had been sheared off, and the astragalus driven through the defect into the sole of the foot below the level of the other bones, followed by the tibia and fibula and apparently without fracture of these three bones. The anterior third of the calcaneus could not be located in this view; the remaining two-thirds of the calcaneus was tilted so that the anterior portion was below the level of the posterior; the metatarsals and other tarsal bones anteriorly were tilted in an opposite direction, thus accounting for the convexity of the sole of the foot. There was no fracture in bones other than the calcaneus. In the *x*-ray giving the anteroposterior view of the right foot the anterior third of the os calcis could be located well down toward the sole and to the medial side of the astragalus.

Having made a detailed diagnosis, the question of treatment became at once the paramount consideration. As you are aware, disability following fracture of the os calcis is very common; and sometimes this disability is of extreme degree, not infrequently totally incapacitating the patient from walking. As most fractures of the os calcis occur in laboring men of very limited education, the importance of this disability is quite apparent. There are usually one or more of the following four complaints: (1) Pain under the external malleolus; (2) pain in the instep, and occasionally in the muscles of the leg, particularly the peronei; (3) pain under the sole of the foot; (4) inability to walk over rough ground. If we examine the *x*-ray plates of the left foot in this case we can see a reason for each of the sources of disability just mentioned.

(1) Pain under the external malleolus: This is due to pressure of the external malleolus on a displaced fragment of bone, usually from the displaced outer plate of the calcaneus, sometimes the portion on which the peroneal tubercle is located. When the injury occurs, and as the calcaneus mushrooms out, the external plate of the bone is displaced outward and upward into such a position that, if uncorrected, it will impinge on the external malleolus when weight is placed on the foot, and become a cause of

total disability. Such a displaced fragment can be seen here, and its position is such that we are not in doubt as to its being a potential cause of trouble (see Fig. 466).

(2) Pain in the instep, and occasionally in the muscles of the leg, particularly the peronei; in other words, flat-foot. This is due to the eversion of the foot, the raising of the heel, and the internal rotation of the head of the astragalus following the crushing of the os calcis, and also to strain or tear of the ligamentous supports of the arch. Therefore, when weight is borne on a foot in which this deformity has not been properly corrected, or so soon after the injury that sound repair of the lacerated ligaments has not been completed, the foot tends to evert, the head of the astragalus rotates inward, the internal malleolus approaches the floor, and the condition of traumatic flat-foot becomes imminent.

(3) Pain under the sole of the foot. A glance at the *x*-ray answers the question as to the cause of this complaint (see Fig. 467). Sharp spicules and angular projections of bone such as these impinging on the soft tissues of the sole when the patient walks very quickly cause great pain and, of course, render such a foot unfit for service.

(4) Inability to walk over rough ground. There are two great joints which are concerned in the principal movements of the foot. Extension and flexion is possible through the ankle-joint proper, the tibio-astragaloid joint. No lateral motion is permitted here; that is obtained through the subastragaloid joint, which really consists of two parts, an anterior and a posterior, separated by the sulcus calcanei. This joint is the articulation between calcaneus and astragalus. It follows, therefore, that the average fracture of the calcaneus, if it reaches the dorsum of the bone, and it usually does, is very apt to involve the subastragaloid joint. As most fractures of the calcaneus are crushing fractures, markedly comminuted, the subastragaloid joint is, therefore, frequently extensively involved by multiple fissures and, therefore, unless due care is exercised in treatment, fracture of the os calcis commonly results in a stiff and painful subastragaloid joint. A person with such a joint cannot walk

over rough ground because of the pain incident to the continued wrenching of this stiff joint. Even though the joint be not stiff, it may become the seat of chronic arthritis, posttraumatic, and in this way seriously handicap the patient (see Fig. 467).

If we are to treat such a case, then, we must bear in mind the various causes of disability to be overcome, and direct our efforts accordingly. We must so mold the foot that there will be no displaced fragments to impinge on the external malleolus; we must restore the arch; we must smooth out the plantar surface of the os calcis, and we must maintain the integrity of the subastragaloid joint. Cotton and Wilson (Os Calcis Fracture—Annals of Surgery, 64, 480, 1916) and Lounsbury (Fracture of the Os Calcis—Surgery, Gynecology, and Obstetrics, 22, 638, 1916) have made valuable suggestions as to the treatment of this condition, and in the summary which I am about to offer use will be made of the work of these men.

It is commonly found that fractures of the os calcis are impacted. If this impaction is allowed to persist, there can be no correction of deformity, and the various causes of disability which have been mentioned will, therefore, be present to disable the patient after the fracture has healed. Sometimes the impaction can be broken up by hand and the fragments molded into position; if not, then the method of Cotton and Wilson offers many advantages, particularly with reference to the correction of the outward and upward displacement of bone beneath the external malleolus. The foot is laid on a sand-bag, medial surface down, and a piece of folded felt is placed on the lateral surface just below the external malleolus, and struck one or several fairly smart blows with a wooden mallet. This is usually sufficient to correct the mushroom deformity. We must now pull the heel down and elevate the arch, pressing back into position any fragments which may tend to become displaced into the sole of the foot. Frequently this can be done manually; if not, the method described by Lounsbury, as adapted from Cotton, will give results. According to this method a urethral sound is passed in front of the Achilles tendon and downward, *i. e.*, plantar traction is made with it, while an assistant makes countertraction on the anterior end of the bone, by pulling up under the instep with a piece of gas-pipe placed transversely to the longitudinal arch. If the Achilles tendon appears to interfere at all with reduction, it may be severed. The heel and ball of the foot are thus drawn toward the center, elevating the arch, and fragments in the sole of the foot are forced back into position. Lastly, it is advisable to make sure that the subastragaloid joint is free by moving the foot transversely two or three times. With the foot in the corrected position a circular plaster-of-Paris cast is applied from the toes to the upper third of the leg. The majority of operators allow the cast to remain on for about four weeks. It is then removed and passive and active motion and massage begun. No weight is to be borne for at least ten weeks, and then cautiously, with the help of arch supports and crutches. Others keep the casts on for ten to twelve weeks and have the patient walk in the casts with the aid of crutches for the last two weeks before the casts are removed. This is the course that has been followed in the case before you. The patient began walking in his casts at eight weeks and they were removed at ten weeks.

Examining these feet, you will observe that the right foot presents outlines which are practically normal; if anything, the arch is a little higher than the average. There is a heavy, dry crust just under the instep marking the area of pressure ischemia noted at the first examination, the tissues in which evidently sloughed; this area is clean and not tender. Most surprising, however, is the fact that the mobility of this foot is not at all impaired. This seems quite remarkable in view of the severity of the injury which it suffered. The appearance of the left foot is not so prepossessing. The heel is somewhat flattened and quite broad in proportion to its height, and there is marked impairment of lateral mobility, which has improved, however, during the past ten days. You will note, also, a practically healed operative scar on the outer margin of the heel. Shortly after the casts were removed I had to chisel off a spur which projected into the edge of the foot. This was seen in the *x*-ray taken after the casts had been applied, and the cast was removed from this foot for the purpose of pushing those fragments up. Upon palpating the sole of the foot with the cast off, however, I failed to find the fragments, so a new cast was applied and the result you see today. The foot is now strong and bears weight well, though it will probably be necessary for the patient to wear a felt pad under the heel to compensate for the pushing upward of the calcaneal tuberosity. In neither of these feet did I tenotomize the tendo achillis, utilize a urethral sound, nor use a mallet, as it seemed easy to reduce and mold them without such aids. The extreme comminution of the heel bone made stable reduction difficult in the left foot; the extremely good result on the right side compensates, in a measure, for the less desirable result on the left, although, even here, the disability will be very slight.

To correct the sources of disability in cases like this is sometimes easy and sometimes very difficult. Bone spurs, whether on the sole or beneath the external malleolus, may be removed with a chisel. Flat-foot may be corrected by the use of arch supports, massage, and corrective exercises; a stiff subastragaloid joint may also yield to persistent, well-directed massage and corrective exercise. Improvement is the rule, but complete return of function is rare.

Attempts have been made to classify fractures of the calcaneus. In general, we must agree with Cotton, that this "is about as useful as classifying cracks in a walnut after the nut cracker is through with it." There is, however, one fairly constant picture about these fractures—the lines of fracture tend to run through the concave articular facet of the calcaneus. The astragalus, a much denser bone than the calcaneus, articulates with the latter by a convex-concave articulation. The part of the astragalus which articulates with the concave facet of the calcaneus fits into it like a wedge with the apex pointing downward directly beneath and in line with the shaft of the tibia. As the great majority of fractures are produced by falling from a height, landing on the feet, there is a tendency for this harder wedge-like portion of the astragalus to drive through the calcaneus at this point, especially if the foot be everted when landing. The resistance of the object on which the foot lands tends to drive the posterior fragment upward and backward. This is well illustrated by the displacements found in the right foot in the case under discussion and also shown in these plates (see Figs. 466, 467). Instances in which fracture is due to muscular strain are relatively very rare, and, while occasionally the bone may be crushed by the wheels of a train or in some similar accident, for practical purposes the mechanism of fracture is that described above.

A word about open operation: This is indicated only in compound fracture, or possibly in the tearing off of the insertion of the tendo achillis by muscular violence. Foreign materials, particularly non-absorbable material, such as silver wire, almost invariably slough.

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SURGICAL CLINICS OF CHICAGO

Volume 3 Number 6

CLINIC OF DR. ARTHUR DEAN BEVAN

Presbyterian Hospital

CHRONIC LUNG ABSCESS WITH FISTULA—TREATMENT BY EXCISION

Summary: Results of operations for drainage of lung abscess—difficulty of effecting cure of postoperative fistulas—available measures; technic of excision of abscess under local anesthesia.

The patient I shall operate on this morning has the following history: He was an officer in the United States Army during the war, and while in the service developed pneumonia, which resulted in the formation of a lung abscess. This case has already been reported in the Surgical Clinics ot Chicago, October, 1918, page 921. Briefly, however, the facts are these: After his pneumonia he did not recuperate and developed what was regarded as empyema on the left side. He was operated upon by a surgeon in Colorado and an incision was made between the seventh and eighth ribs in the axillary line on the left side, and the pleura opened. The surgeon was astonished to find no pus and a collapsible lung. Pneumothorax developed immediately, and the surgeon did what proved to be a very wise thing. He made an immediate closure of the wound without drainage. The operative pneumothorax disappeared within a few days, the air being completely absorbed. The patient's general condition, however, did not improve. He ran a septic temperature for a number of weeks, sometimes as high as 104° F. He coughed up some very foul material and was finally brought to the Presbyterian Hospital.

He was kept under observation for ten days or more before we located fairly definitely the abscess of the lung. This was opened by the method which we employ in this Clinic: operating under local, finding the abscess with a needle, making a fair-sized canal with the electric cautery into the abscess, and introducing a rubber drainage-tube through this canal. He recovered from the operation and improved very much. After he had gained 10 or 15 pounds in weight and was entirely free of fever, I attempted to obliterate the abscess with bismuth paste. I injected probably ½ dram through the tube, and this was followed by a very violent fit of coughing. The patient coughed up some bismuth paste, showing that the abscess cavtiy communicated directly with a bronchus. The injection of even ½ dram of paste did him a great deal of damage for a few days. It was followed by a sharp rise in temperature. This, however, finally subsided, and he got rid of all the bismuth either by coughing it up or expelling it through the rubber tube in the fistula. I then decided simply to drain the abscess with a drainage-tube for a long time, and sent him to California for the winter. While in California he picked up weight and strength and improved until his general condition was excellent. He began, however, to have disturbance with the drainage-tube and there was a very free discharge of mucopus from the tube varying in amount from day to day, sometimes very free and sometimes quite scanty.

During this period of a number of months while he was under observation I took several *x*-ray pictures of his chest, which showed a damaged triangular area of the left lower lobe, between the diaphragm, chest wall, and pericardium. I also examined his chest with the fluoroscope, and found that I could pass a probe through the fistulous tract into a small abscess cavity and then into the bronchus. When the probe entered the bronchus it would produce a very violent fit of coughing, associated with the coughing up of some blood. Bacteriologic examination of the sputum failed at all times to show tubercle bacilli.

The man has recently returned from California and I have gone over the case very fully and very frankly with him, and have advised him to have an operation for the purpose of definitely curing the abscess and getting rid of the continued discharge. I have a number of abscess of the lung cases now that have worn tubes for a great many months or years, and these patients are able to keep in very fair general condition as long as they maintain good drainage. It is often a very serious and difficult problem to determine what to do with these old chronic abscesses that refuse to heal. We have been able to cure some of them with bismuth paste and some of them by resecting a number of ribs over the abscess and allowing the chest wall to collapse. I have not had very much experience with lobectomy or partial lobectomy, so often advised and carried out by a number of surgeons. I have regarded the operation for resection of a portion of the lung as one that carries with it a grave risk and one that was uncertain as to its curative effect, and one, therefore, to be avoided as a general proposition.

I shall do this operation this morning under local anesthesia, using $\frac{1}{2}$ of 1 per cent. apothesine and 1 : 100,000 adrenalin. It will be a slow and rather tedious operation for you to witness, because I shall take plenty of time to the various steps and attempt to anesthetize the tissues thoroughly before they are invaded. I infiltrate first the soft parts around this fistulous tract and then the chest wall pretty widely, the size of my hand, so that I can resect two, three, or four ribs as conditions require. The extent of the operation I cannot tell you beforehand. My plan, however, is to resect enough ribs to expose the abscess fully and enable the chest wall to collapse and obliterate the abscess, and possibly to split the abscess open so that we can make a wedge-shaped cavity which we can compel to heal from the bottom, as we used to do so frequently in connection with cases of necrosis of the tibia, where we would chisel out a trough in the tibia, remove the dead bone, and secure complete wound healing either by epidermization from the edges of the wound or by covering the trough with skin-grafts or with a pedicle flap of skin.

I want to call your attention to one interesting fact in connection with this fistulous tract, that is, that it is lined with perfectly healthy-looking epidermis as far as I can see into the tract. After infiltrating the soft tissues of the chest wall I shall block the intercostal nerves with the same solution in their grooves on the sixth, seventh, eighth, and ninth ribs, opposite the angle of the ribs. Now that the entire field is anesthetized, I make an oblique incision directly along the ribs from the angle of the seventh rib downward and outward, about 6 inches in length, enclosing the fistulous tract (Fig. 468, *a*), dissect back the skin and soft tissues down to the sixth, seventh, eighth, and ninth ribs. I free the seventh, eighth, and ninth ribs of their periosteum for a distance of about 4 inches and resect 3 inches of these ribs. As I do this I find a rather interesting result. As the chest wall becomes flaccid after removal of the rigid ribs I can push the chest wall inward and force some pus out of the fistulous opening. I now split up the fistulous opening for a distance of about 3 inches, and find that it leads me into an abscess about the size of a small hen's egg (Fig. 468, *b*). I can mop out a little pus from this abscess cavity, and I find, as I split the abscess cavity open, dividing some indurated, edematous lung tissue over it, that the abscess cavity is lined with a rather tough pyogenic membrane that looks almost like skin or tough mucous membrane. I can see very distinctly at the upper end of the abscess that a good-sized bronchus, about the size of a small lead pencil, opens into the abscess cavity and the air can be heard whistling in and out (Fig. 469, *a*).

I shall infiltrate the lung tissues around this abscess cavity, and the thought occurs to me that I may be able to dissect out the abscess entirely, and although I have never done this in similar cases, I believe that conditions here lend themselves very well to such a procedure, and I shall attempt it. You will notice that I have not removed as yet the fistulous tract which was lined with skin. I shall use this as a tractor to draw the abscess cavity down so that I can dissect it out. With a very sharp knife I dissect out this lining membrane which is about as thick as fair-sized blotting-paper. You will notice that the lung tissue is fairly vascular and that I have to apply a number of artery clamps in order to control the hemorrhage. I am surprised at one thing here in the operation, that is, that I can draw down the lung tissue into the operative field so as to make the entire operation very accessible. I bring it down using the

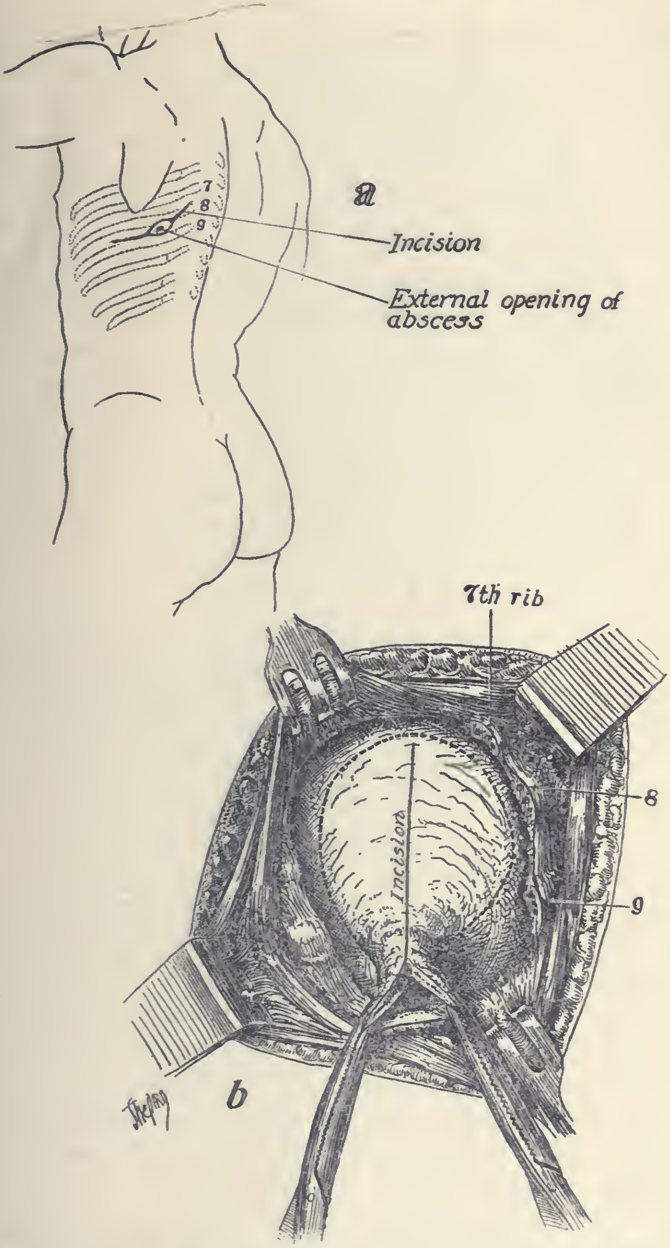

Fig. 468.—*a*, Incision; *b*, 3 inches of seventh, eighth, and ninth ribs resected, exposing pleura. Dotted line indicates extent of abscess.

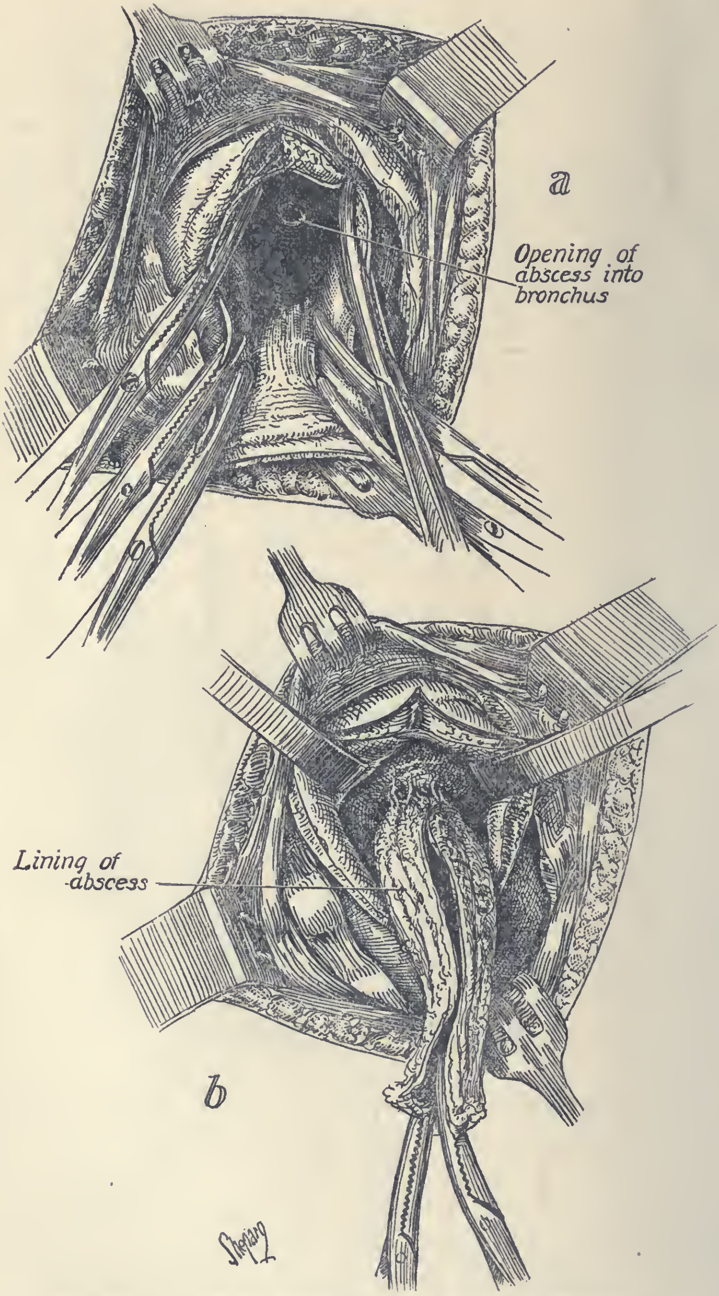

Fig. 469.—*a*, Abscess opened; *b*, abscess wall dissected out.

fistulous tract as a tractor and also the artery forceps with which I have clamped the lung tissues on either side of the abscess (Fig. 469, *b*). As I continue the dissection toward the diaphragm anteriorly I open into two smaller abscess cavities, one about the size of a cherry and one about the size of a bean. I have to extend my dissection outside of these and resect a small part of the lobe of the lung including this infected tissue. Continuing the dissection and infiltrating ahead of the dissection with local anesthesia, you will notice that I am able to dissect out the entire abscess cavity just as one would dissect a wen from the scalp. The comparative ease with which we have been enabled to do this is rather a surprise to me. I cannot help but feel that this method of handling lung abscess may open up a new field of work. Just what to do with the open bronchus at the upper end of the abscess I am somewhat uncertain and undecided. I believe, however, it would be of little value to attempt to sew it together with catgut sutures. I think, on the whole, the safest plan will be to pack this cavity with iodoform gauze, leaving a boat-shaped cavity which I shall compel to heal by granulation and shall endeavor to cover with epidermis either from the edges of the incision or later by Thiersch grafts (Fig. 470).

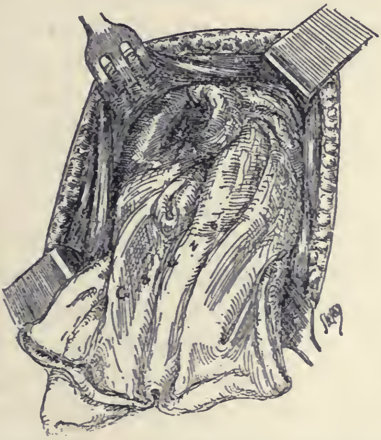

Fig. 470.—Operation completed; site of abscess packed with gauze.

After-management.—I shall make no effort to close the skin incision except that at either end I shall introduce a black silk suture to diminish somewhat the extent of the incision, leaving, however, about 3 or 4 inches of the incision open, which I shall pack with iodoform gauze. Over this I shall place a large gauze compress.

I cannot help but feel that this is one of the most interesting pieces of work that we have done in the clinic for a long time, and that it may lead to some very interesting developments. I have a number of patients now with lung abscess of this chronic type, and the thought occurs to me that it might be well to undertake this same procedure in a number of cases and test it out. Operations of this kind done under local anesthesia, although slow and tedious, are, in my judgment, very much safer than operations done under general anesthesia. Whether it will be possible in other lung abscess cases to follow the same technic that we have done so easily in this case is, of course, a question, and yet I feel that certainly some of these cases can be handled in this way. I am quite confident that this will lead to a permanent cure in this patient's case, that we have removed entirely the damaged portion of the lung, and that we will be able to obtain complete closure either by granulation and epidermization or by skin-grafts or possibly with a pedicle flap.

After-history.—The patient experienced a good deal of pain for the first twenty-four hours after operation. There was a small amount of mucopurulent discharge on the gauze, which was changed at the end of forty-eight hours and changed again at the end of seventy-two hours. There was a fairly sharp rise in temperature up to 102° F. the second and third days. This came down to normal on the fourth day. The wound under the iodoform gauze dressing was kept in very good condition and was granulating rapidly.

x-RAY DIAGNOSIS OF GALL-STONES

Summary: Two patients with vague abdominal symptoms, showing definite shadows in the *x*-ray compatible with being the shadows of gall-stones; pathology at operation; *x*-ray of little value in the diagnosis of cholelithiasis.

This morning I shall have the opportunity of showing you two very interesting gall-bladder cases, at least two cases in which the diagnosis of gall-bladder disease has been made from evidence which we have obtained. I am personally very much interested in them because they represent an exception to the rule, as to the value of the *x*-ray evidence, which we have for years accepted in this clinic.

Both patients are women with rather vague indefinite abdominal distress and without the clinical picture of gall-stone colic attacks. Both of them show definite shadows in the region of the gall-bladder consistent with being the shadows produced by gall-stones. Shortly after the *x*-ray was introduced into medical work and after I had employed it in the diagnosis of stone in the kidney, I experimented with it in gall-stone cases, and found that it was very difficult to show even a large gall-stone with the *x*-ray in the great majority of cases. In order to test the matter out I did a series of experiments, the most important being taking a beef's liver and making a long incision in it, putting in this incision a dozen different gall-stones taken from a dozen different patients, closing the incision with sutures, and then taking an *x*-ray picture of the beef's liver to determine whether the gall-stones would throw definite shadows. I found that the ordinary gall-stone composed largely of cholesterol would not throw any more of a shadow than the liver tissue itself. A few bigger gall-stones, one a large stone which I removed from the cystic duct and the other a large single mulberry stone which I removed from the gall-bladder, threw quite definite shadows. These were heavier than the ordinary cholesterol stone, and contained, on analysis, a good deal of carbonate of calcium. Repeated experiments of this kind convinced me that the great majority of gall-stones would not throw a shadow when exposed to the x-ray. This was in keeping with the attempts that we had made to obtain x-ray pictures of gall-stones in patients. It is, of course, difficult to give definite figures and percentages as to what percentage of gall-stones will show in the x-ray and what will not, but I think it is safe to say that less than 10 per cent. of gall-stones will throw definite shadows which can be made out in x-ray examination. There has, of course, been a good deal of improvement made in x-ray technic in the last twenty years, and I think it is fair to say that a larger percentage of stones can now be shown than formerly, but I think the rule would hold good, at least it has in our own clinic, that the x-ray furnishes us definite positive evidence of the existence of gall-stones in less than 10 per cent. of all gall-stone cases. I mean, of course, by definite evidence, shadows of stones. When it comes to suggestive evidence of gall-stone disease, such as a high-lying duodenum, or evidence that is interpreted as meaning adhesions about the gall-bladder, I want to say very emphatically that I place no confidence in evidence of this kind. In our clinic, therefore, we make the diagnosis of gall-stone disease practically independent of x-ray evidence. We very frequently have these patients examined with the x-ray, as we have had in these two cases, and if there is a definite positive shadow we accept it for its face value as a piece of definite evidence. If, on the other hand, there is no shadow, we do not place any confidence whatever on the negative evidence obtained. It is, therefore, singular that we should have in this clinic on the same morning two patients with the clinical diagnosis of gall-stone disease and in both cases definite shadows consistent with being gall-stones.

The first patient is a Jewess, thirty years old. She consulted me about a year ago for abdominal distress, which at that time we regarded as probably chronic colitis, and I advised her against having an operation, placing her upon medical management. She improved somewhat, but came back to us about a week ago complaining of tenderness over the gall-bladder, rather marked constipation, no definite history of gall-stone attacks, but with enough gall-bladder tenderness to make one think seriously of a gall-bladder infection. x-Ray examination shows quite definitely a dozen small shadows about the size of good-sized currants apparently in the gall-bladder. There has been no evidence of obstruction in the cystic duct with resultant enlargement of the gall-bladder. There has been no jaundice.

On analyzing the facts I have consented to operate on her. I must confess that the definite shadows of gall-stones furnish us a piece of evidence which makes me more willing than I otherwise would be to operate on this particular case, because the abdominal distress and abdominal symptoms generally are not sufficiently typical of gall-stones to warrant my making a definite clinical diagnosis unless we have the additional evidence furnished by the x-rav.

The patient is now anesthetized and we shall make our usual **S**-shaped incision. Let me again call your attention to the fact that we leave two-thirds of the rectus muscle to the outer side of this incision so as to avoid any paralysis of at least two-thirds of the muscle-fibers.

Opening the peritoneal cavity I find a rather normal looking gall-bladder, a little flaccid, as though it had at one time been more distended than it is now and had partly emptied itself. On palpating it I can feel a dozen or more moderate sized gall-stones in its caliber and one which seems to be crowded pretty well into the neck of the gall-bladder. There are no stones in the common duct. Examination of the duodenum, pylorus, and pyloric end of the stomach shows nothing abnormal. Standing on the right side of the patient I free the fundus of the gall-bladder from the liver so that I can separate at least two-thirds of the gall-bladder from the fundus down toward the cystic duct from the groove in the liver. You will notice that I now change my position and step to the left side of the patient. I want to again emphasize the importance of this piece of surgical technic because this maneuver makes it much easier to remove the gall-bladder safely and to clamp the cystic duct without taking any chance of injuring the common or hepatic ducts than would be possible if the operator remained on the right side of the patient. In freeing the lower part of the gall-bladder, or at least that portion of the gall-bladder leading to the cystic duct, I clamp the cystic artery and some connective tissue which binds the gall-bladder pretty firmly to the liver at a point about 1 inch posterior to the cystic duct proper; divide the cystic artery and this connective tissue with the scissors. This enables me, with the blunt closed end of a pair of artery forceps, to separate the neck of the gall-bladder from the liver and to expose the cystic duct and isolate it from any surrounding tissues. You see we now have the gall-bladder suspended from the cystic duct like a pear with its stem. I clamp the cystic duct with a pair of full curved forceps made for that particular purpose and palpate quite carefully the proximal end of the cystic duct to be sure I am leaving no stones. I place another pair of curved forceps just proximal to the first pair and divide the cystic duct with curved scissors. In this case I ligate both the cystic artery and cystic duct with the same ligature of moderate sized catgut. I do this because the entire pedicle composed of cystic artery and duct is rather small and we can handle it very easily in this way. These full curved forceps made for this special purpose are of particular value because they enable me to slip the catgut proximal to the forceps and be sure that when the catgut is tied the forceps are not included.

I now remove the forceps and shall introduce a split rubber drain containing a wick of iodoform gauze. This is carried down to the stump of the cystic duct and left in contact with the rough surface of the liver from which the gall-bladder has been dissected. The incision is closed in the usual way with catgut through the peritoneum, silkworm-gut sutures through the rest of the layers, placing them about $\frac{2}{3}$ inch apart, medium sized catgut in the anterior sheath of the rectus, and silk in the skin.

Some doctors who have visited our clinic have sometimes asked the question, why we drain these cases and why we do not make a complete closure as has been advocated by some surgeons. Our experience is that a certain number of these cases leak bile for a few days, sometimes for a week or two. As a rule they do not, but the leakage is sufficiently frequent to make me believe that it is wiser to drain. I take it for granted that in gall-stone cases we are dealing with, as a rule, a moderately infected mucous membrane of the bile tracts, and that not infrequently because of that fact we have a slight local infection which is much safer dealt with by temporary drainage than by immediate and complete closure. We have learned to rely upon and have found a good deal of comfort in the use of iodoform gauze in these cases. I think the moderate infection of the bile tract mucosa is, as a rule, taken care of by the iodoform gauze, and if any infection does occur, we are always very thankful that we have left in the drain.

Note.—The patient went on to an uninterrupted and very satisfactory recovery. The gall-stones were put in a piece of liver tissue and x-rayed, and we are to have them examined chemically to see if we can determine why these particular gall-stones caused such definite shadows.

The second patient we shall operate upon this morning is a medical colleague of mine, a woman who has done exceptionally outstanding work in her subject. She has been under par for a number of months, with rather vague abdominal distress. She has had some arthritis and some skin eruptions, similar to the eruptions that occur not infrequently in rheumatic infections. She has consulted a number of physicians and has placed herself upon a strict diet and has looked into the question of a possible focal infection. She has had her teeth examined and put in condition and tonsils removed. Her general condition is at present fair. She was in a sanitarium under medical management some months ago and had an expert make an x-ray examination of the abdomen. He found a shadow which he believed was a gall-stone in the gall-bladder. She has never had any outspoken, clean-cut gall-stone colic attacks. She has, however, had definite tenderness over the gall-bladder and some abdominal tenderness in that region, nothing, however, sufficiently severe to be characterized as gall-stone colic.

She came to me a few days ago fully determined to have an operation on her gall-bladder. I referred her to a medical colleague of mine, Dr. Joseph L. Miller, and had her go and see Dr. Hollis E. Potter and have *x*-ray plates made to confirm the evidence that had been found originally by Dr. Case, of the Battle Creek Sanitarium. Dr. Potter's *x*-ray pictures showed a definite shadow consistent with being that of a gall-stone (Fig. 471).

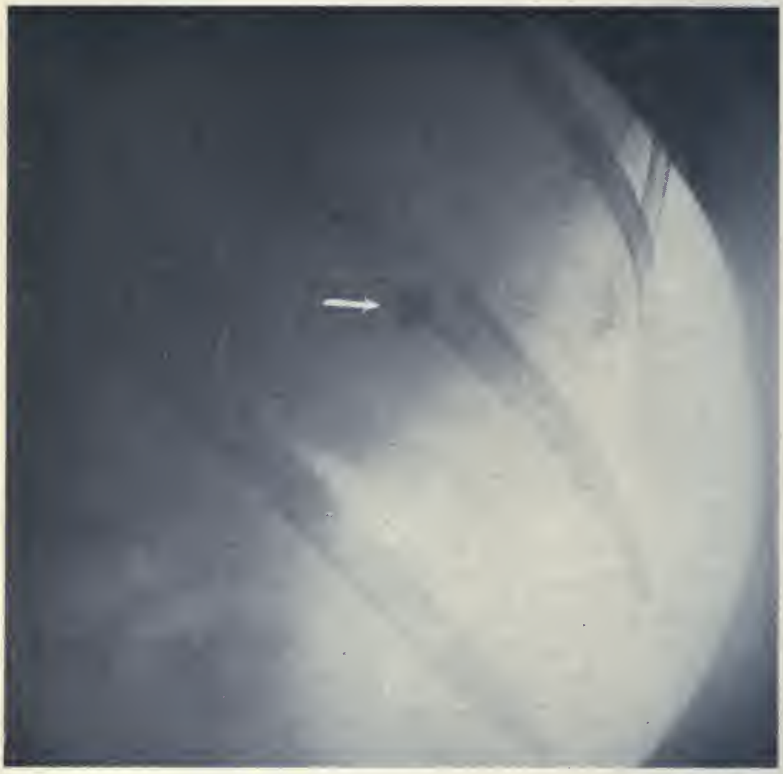

Fig. 471.—*x*-Ray photograph showing a definite circular shadow superimposed on the liver shadow and compatible with being that cast by a gall-stone.

Dr. Miller, after looking into all the evidence, recommended that an exploratory at least be made, and he believed that it would disclose gall-stone disease.

We shall make our usual **S**-shaped incision just as we did in the previous case. On opening the peritoneal cavity I find again a rather normal looking gall-bladder, but on picking it up between the thumb and finger of my right hand I find a large nodular, single stone in the neck of the gall-bladder. I shall remove it just as I did in the previous case, standing first on the right side of the patient until I have freed the fundus and posterior two-thirds of the gall-bladder freely from the liver, then stepping to the left side of the patient and completing the more difficult dissection of separating and isolating the cystic duct. This is done, as you notice, with little difficulty. I clamp the cystic artery separately, clamp the cystic duct, and remove the gall-bladder and posterior portion of the cystic duct. I find no evidence of any lesion of the common duct, pancreas, duodenum, pylorus, or pyloric end of the stomach. We close the incision in exactly the same way as in the previous case, leaving in a split drainage-tube containing an iodoform wick.

On opening the gall-bladder removed you see that it contains a single, very peculiar looking stone covered with small round projections, looking like an encapsulated mulberry calculus. The stone feels very heavy in one's hand, very much heavier than an ordinary gall-stone, and I have no doubt that we will find it contains a good deal of carbonate of calcium, and that is why it gives such a definite shadow. We shall use this calculus in the same experiments that I said we would make with the calculi removed from the first patient, and we shall also have it carefully examined.

Before closing this morning I want, in connection with these cases, to refer to a case which we operated on several years ago in this clinic in which we believed that we had very definite evidence of stone in the common duct. A minister was brought to the service with profound jaundice, due, as we believed, to common duct obstruction. The *x*-ray picture showed a small, rather round or oval calculus about ⅓ inch in diameter apparently in the common duct. I operated upon that patient and found a calculus of about the same size and approximately the same shape as the shadow which we had on the *x*-ray plate. He went on to a very satisfactory recovery. I was astonished, however, when I examined this stone to find how light it was in the hand,

and I wondered why it had thrown such a definite shadow. In experimenting with it I found that we could not obtain a shadow of the stone in a piece of liver tissue. I therefore took a picture of the patient after he had recovered, and very much to our surprise we found that he still had exactly the same shadow that we had found before operation. It proved that the stone which we had removed, although it was apparently the same size, was in no way responsible for the shadow found on the *x*-ray. We came to the conclusion that that shadow was either a silent calculus in the kidney or a shadow due to some calcareous deposit in a lymph-gland.

I mention this case because in this second case which we have just operated upon the shadow shown in the *x*-ray is apparently in the liver tissue itself. After this patient recovers we shall take another *x*-ray picture and see if she still has this same shadow. In the light of the experience which we have just referred to I shall not be greatly surprised if it were shown that she still had the shadow which we have found on this plate, and in her case, of course, it will have to be interpreted as probably a calcareous deposit in a lymph-gland.

There is just one other point which I would like to mention in connection with the *x*-ray in these cases, that is, the inflation of the peritoneal cavity with oxygen gas before taking *x*-ray pictures. This method was demonstrated at the last meeting of the American Medical Association at Atlantic City, and some of the results obtained were certainly very definite, and we were all impressed with the fact that this might increase very greatly the usefulness of the *x*-ray as a means of diagnosis in abdominal lesions.

FIBROMA OF LARGE INTESTINE

Summary: A patient presenting a left-sided abdominal tumor, melena, and increasing evidence of intestinal obstruction; diagnosis; discovery at operation of submucous fibroma of splenic flexure heading intussusceptum into descending colon and sigmoid; advantages of muscle-splitting incision.

This is a case of Dr. B. W. Sippy's, in which, even after a most exhaustive study, a definite clinical diagnosis cannot be made.

The patient is a man of thirty-four who has had for a year or more hemorrhage from the bowel and, from the evidence obtained, quite certainly from the large intestine. At one time a diagnosis of ulcerative hemorrhagic colitis was made and the patient put upon medical management, on which he improved a good deal. Recently, however, symptoms have become worse, and a new feature has presented itself in the case, in that a large definite tumor mass has been recently discovered in the left lower quadrant of the abdomen. There has been no evidence of tuberculosis either in the lungs or in the intestine, although the possibility of tuberculosis must be considered. His age makes carcinoma improbable, although it does not eliminate that possibility. The definite and greatest pieces of evidence that we now have are that the patient is thirty-five years of age, that he has had bleeding from the bowel for more than a year, that the hemorrhage is evidently from the large intestine. There has been no associated fever suggestive of tuberculosis, and now within the last few weeks there has developed a large, definitely palpable mass in the left lower quadrant of the abdomen associated with evidences of partial obstruction of the large intestine. I am quite frank in saying that I am unable, and Dr. Sippy feels the same way, to make a definite clinical diagnosis from these facts. On account of the obstructive symptoms that have disturbed him, and the presence of this tumor mass, I regard an exploratory as imperative to determine the character of the lesion, and we shall, of course, do whatever is necessary if we are able to find the definite pathology.

I shall employ here an ether anesthetic and shall do as we usually do in these cases, make a left muscle-splitting incision for the purpose of diagnosis, and we shall probably do whatever operative procedures are required through this same incision. You see that I am making exactly the same sort of an incision that we use for an appendix operation except that it is upon the left side. I shall make it probably half again as long as an ordinary appendix incision (Fig. 472, *c*). This divides through the skin, superficial fascia, and external oblique. I now retract the aponeurosis of the external oblique widely and split the fibers of the internal oblique and transversalis with two blunt dissecting forceps. This brings me down to the peritoneum. I now make an incision through the peritoneum parallel to the fibers of the internal oblique and transversalis. Introducing both hands, I now stretch this incision pretty widely so as to give me a full exposure of this field. I at once come down to the large intestine, apparently the sigmoid, and draw this out through the incision. The intestine is perfectly movable, but it contains a large mass which is apparently inside the bowel and which I can see shining through the distended intestine. It feels to me as though we had a mass about the size of an egg or a little larger inside the intestine at this point. From its color it looks as though it might be some foreign body, like a hair-ball. It is also fairly movable inside the caliber of the intestine. I am unable to make a definite diagnosis even now that we have this loop of intestine in our fingers. I shall open the bowel, and, as you see, I first clamp the intestine off with two pairs of intestinal forceps protected with rubber tubing, so as to prevent any escape of fecal material and also to control the bleeding. Walling off the intestine with two pads, I make an incision through the longitudinal band of fibers in the large intestine over this mass. This incision, you will notice, is about 2 inches in length. As I open the bowel I push the mass out through this incision in the bowel wall. It looks at first as though it might be a foreign body, like a hair-ball, and yet as I attempt to draw it out of the in-

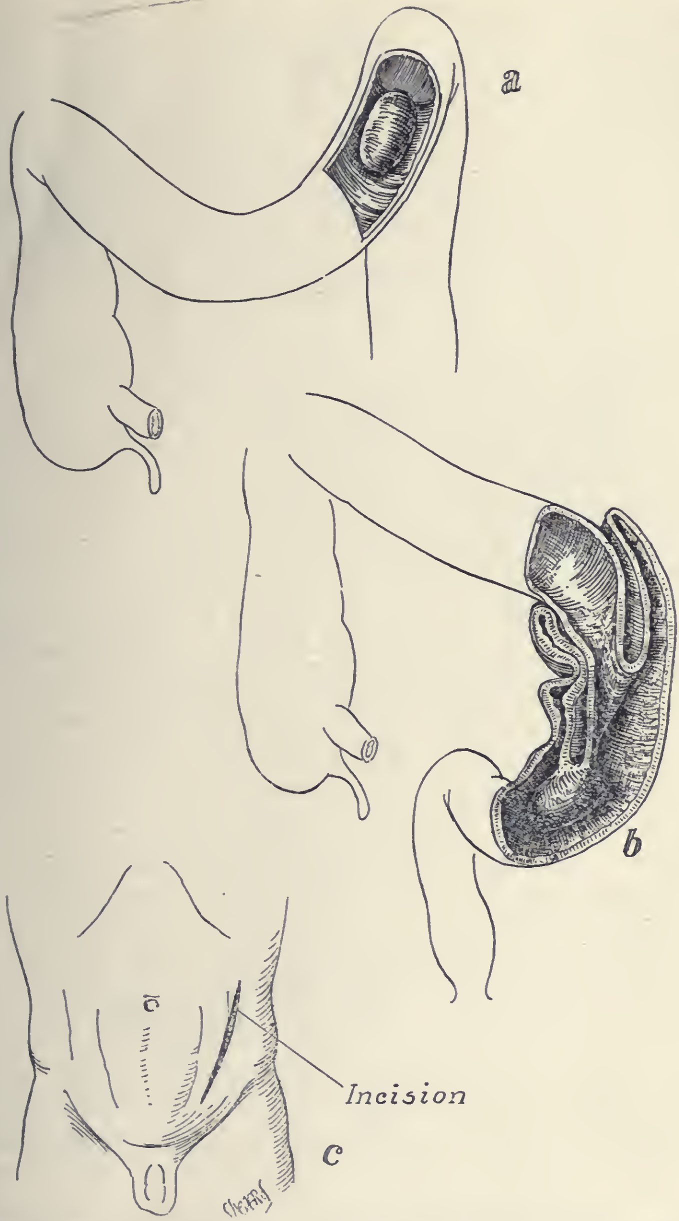

Fig. 472.—*a*, Original site of tumor; *b*, invagination of intestine; intussusceptum headed by tumor; *c*, incision for exploration of left lower quadrant of abdomen.

testine I find it is attached to the mucosa of the intestine. Examining it more carefully, I find that it is a tumor about the size of a large egg springing from the inner surface of the intestine. The mucous membrane covering the tumor is necrotic and black.

I shall attempt to dissect the tumor from the bowel wall. Dividing the mucous membrane at the base of the tumor, I find I can dissect the tumor out rather readily as one can a myoma from the uterus. There is a definite capsule to the tumor and a definite line of cleavage which I can follow. I have now removed the tumor (Fig. 473, *a*). I split it open and find that it is evidently a fibroid tumor which has become gangrenous from a cutting off of its blood-supply. I now carefully sew up the mucous membrane of the intestine at the point from which I have dissected the tumor, doing this with a continuous suture and controlling the hemorrhage completely (Fig. 473, *b*). Now, with three rows of sutures, I close the wound in the intestinal wall which I made to expose the tumor. You notice I do this with a great deal of care so as to control the bleeding perfectly and to obtain a very accurate closure so as to prevent any possibility of leakage, using this suture through the mucosa and then a second through the muscularis and peritoneum, and finally a very accurately applied Lembert suture (Fig. 473, *c*). Cleaning out with a moist pad around the suture line, I now remove the pads, and it is evident that I have to deal with a very extensive invagination of the large intestine. I shall attempt to disinvaginate the intestine, and after I have accomplished this I shall examine the bowel carefully to see whether it will be necessary to resect the intestine on account of gangrene at any point. I shall handle the intestine with the greatest possible care in this disinvagination. I am doing this very slowly, as you see, in the gentlest possible way, and it takes eight or ten minutes for me to disinvaginate the bowel. You will notice that the amount of bowel that was invaginated was surprisingly large, certainly 15 or 18 inches. Now that I have succeeded in disinvaginating it completely, you will see that the point of origin of the tumor must have been about the splenic flexure of the colon (Fig. 472, *a*, *b*). That is evident

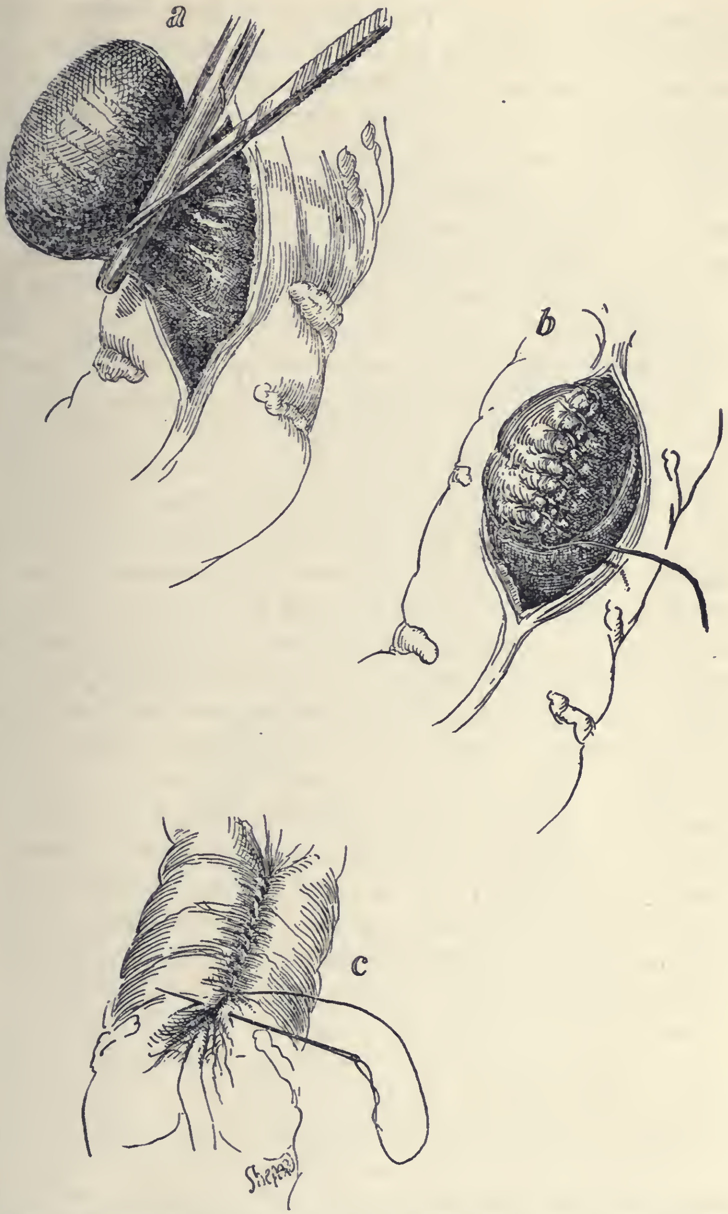

Fig. 473.—*a*, Excision of tumor; *b*, mucous membrane sutured over site of tumor; *c*, Lembert suture completing closure of incision in intestinal wall.

because we can see that the left edge of the omentum is just about at the point where the tumor was situated. There is no evidence of gangrene of the intestine and I do not think it will be necessary to resect it. I shall, however, for safety anchor this portion of the bowel to the external incision and leave some drainage down to this point, so that in the event that any leakage does occur from gangrene of the bowel, we shall have it under very good control (Fig. 474).

The rest of the muscle-splitting incision is closed in the usual way. I want to call your attention to the great movability of this entire section of the large intestine, that I can bring the splenic flexure down and out through this incision in the left lower quadrant without any difficulty. Of course, this movability is the result of the changes that have occurred gradually, and it is evident that this invagination is a chronic affair and has been going on for a long time, for it is only recently that his condition has become so aggravated as to produce partial obstruction and give rise to the picture of a definite tumor. It will, of course, be necessary for us to make a microscopic examination of the mass, but I should say without much hesitation from all the evidence that it is a benign tumor, presumably a fibroma springing from the submucosa. We have had several similar experiences, but nothing that is absolutely identical with this case. I have operated upon a number of cases where papilloma of the large intestine had produced intussusception. Sometimes these are single, but, as a rule, the cases have been those in which a large papilloma had produced intussusception, but in which we found multiple papillomatous tumors. Apparently in this case we have a single tumor to deal with.

Note.—The after-history of the case was particularly interesting. He had, as we feared, an infection of the wound, evidently a colon infection with a very foul odor. I immediately opened up the wound fully, cleaned it out thoroughly with peroxid, and dressed it with moist boric dressings. Very rapidly the colon infection disappeared, in fact, surprisingly rapidly, so that by the tenth day we could bring the edges of the incision together with adhesive strips and healing was complete within

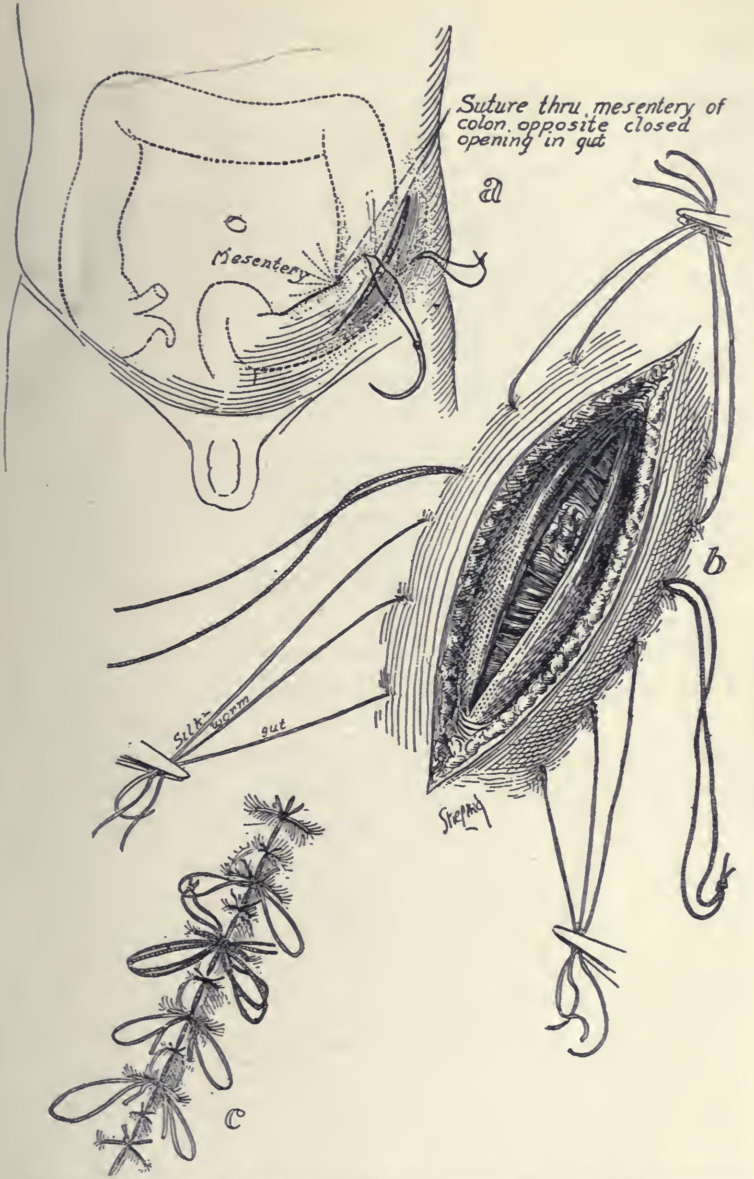
Suture thru mesentery of colon opposite closed opening in gut
a
Mesentery
b
Silk-worm gut
c

Fig. 474.—*a*, Heavy silk suture passing through all layers of abdominal wall and mesocolon anchors suspicious portion of colon to region of incision; *b*, gridiron effect of the muscle-splitting incision; the incision in the internal oblique and transversalis (seen in depths of wound completely sutured) lies at right angles to that through overlying tissues; *c*, closure completed. Tension sutures tied with bow-knots to facilitate reopening of wound if that becomes desirable.

about fifteen or eighteen days, almost as rapidly as though no infection had occurred. During this period of the colon infection the man's general condition was very good. The temperature at first went up to 102° or 103° F., but came down to normal in a day or two after the wound was opened up and irrigated. He had no evidences of peritonitis and no evidence of paralytic ileus or mechanical obstruction to the intestine. He went on to a most satisfactory recovery without any tendency to hernia. I want to emphasize this last point because it demonstrates very clearly the value of the muscle-splitting incision in this case. With the muscle-splitting incision, even though a sharp acute infection occurred, there was no difficulty in preventing any hernia or any protrusion of the abdominal contents.

Microscopic examination of the specimen showed that it was a simple fibroma.

CLINIC OF DR. DANIEL A. ORTH

St. Mary's Hospital

MANAGEMENT OF NEGLECTED CARCINOMA OF THE BREAST

Summary: A patient presenting a large ulcerating carcinoma of the breast with extensive regional glandular involvement and marked edema, with pain of the arm and hand on the affected side; technic of preliminary Roentgen ray and radium treatment—results; radical operation with the cautery knife; protection of axillary structures from contracting scar; postoperative dressings.

This patient is a woman fifty-four years of age, admitted to the hospital July 19, 1918, suffering from an inoperable cancer of the right breast.

Family History.—Negative—no cancer on either side.

Menstrual History.—Puberty at fifteen years of age. Never had any disturbances of the sexual organs. Climacteric at fifty. Four para—two full term; two miscarriages.

Habits.—Good; appetite poor; bowels regular.

Present Complaint.—One year ago she noticed a lump about the size of a small hickory nut in the upper portion of her right breast. This gradually became larger. The mass was painless until it began to ulcerate about six weeks ago. About this time she noticed a swelling in the axilla which rapidly grew larger. Four weeks ago her arm began to swell and pain, causing sleepless nights. She has been taking anodyne tablets to relieve the pain. She has lost considerable weight during the last month and has noticed rapid graying and loss of hair.

Physical Examination.—The patient is a little old woman of waxy color, who looks acutely ill. Both pupils are contracted. Her pulse is slow and full, the left being greater than the right. The artery walls are not palpable. Heart and lungs are negative.

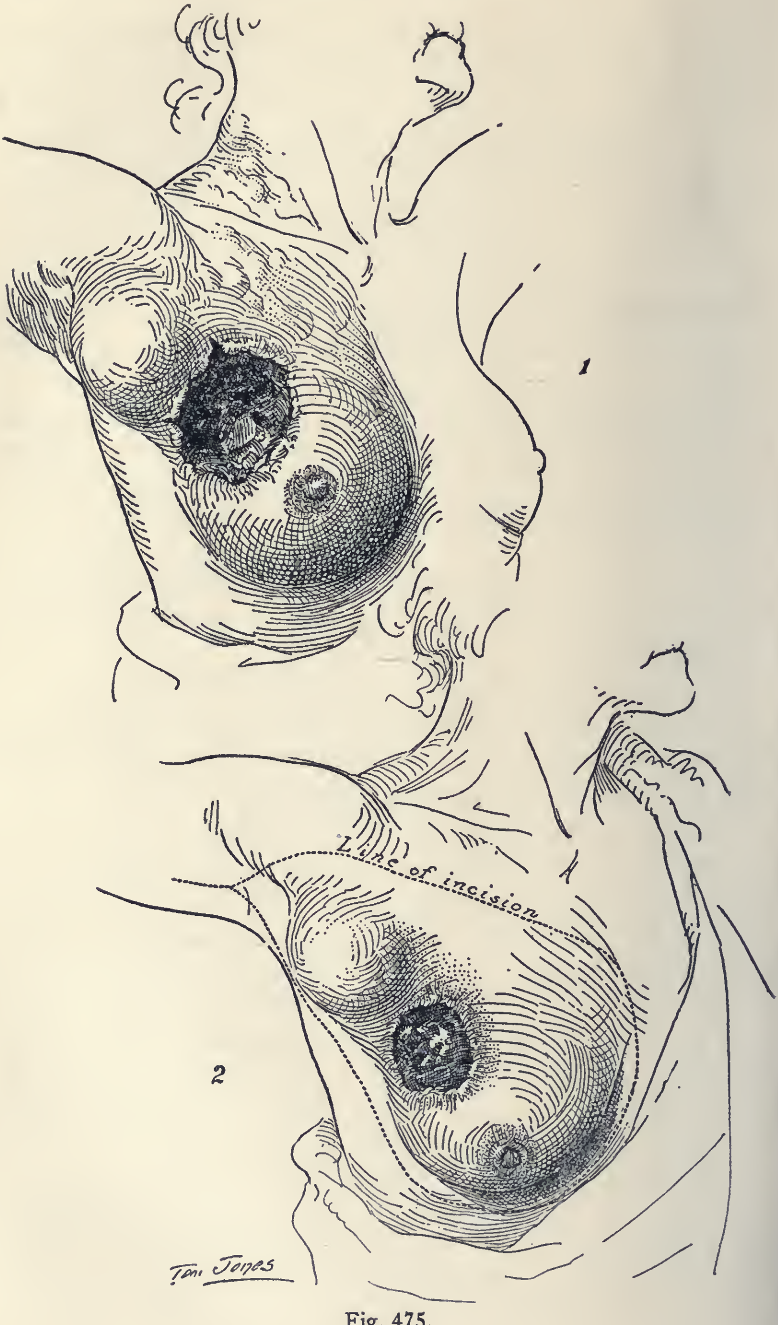

Fig. 475.

In the upper quadrant of the right breast there is a large, necrotic, ulcerating mass (Fig. 475, 1). The ulcer is elliptic, measuring 4 x 5 inches. The edges are irregular and somewhat raised, and the surface of the ulcer is covered with a grayish, necrotic, granular mass. The breast is firmly fixed to the chest wall and is edematous and hard throughout. There is induration of the pectoralis major muscle and an invasion of the infraclavicular lymph-glands. The axillary glands are matted together and form a mass 3 x 4 inches in size. These glands are hard and immovable. The entire right upper extremity is hard and edematous.

From the history of the case you can readily see that an operation was contraindicated when this patient was admitted, for the following reasons:

1. Extensive ulceration and infection of the skin.
2. Marked cachexia.
3. Inability to remove the entire disease, both breast and nodules being fixed and immovable.

The case looked so hopeless that several surgeons advised her not to have any surgical interference, as this would only shorten her life. She was given a prescription for some anodyne tablets to relieve the pain in the arm and produce sleep.

As is our practice in all tumors of the breast, as a preliminary step to the radical operation, this patient was referred to Dr. Henry Schmitz for Roentgen ray and radium treatment. His wide experience has enabled him so to perfect the raying technic in these cases that recurrences are exceptional. The patient received the following treatment:

July 20th, 100 mg. of radium element were applied to the ulcer for fourteen hours and to the four fields surrounding the ulcer for a duration of six hours each, the total amount being 3800 milligram hours of radium element.

July 27th, seventeen Roentgen ray applications of 75 milliam-

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Fig. 475.—1, Appearance of breast on admission to hospital. Note crater ulcer and numerous nodules in axilla and in the supra- and infraclavicular fossæ; 2, patient after massive doses of Roentgen rays and radium. Line of operative incision indicated by dotted line.

pere minutes each were given, the filter being 4 mm. of aluminum, focal distance 20 cm., and spark gap 8 inches.

August 6th, four Roentgen ray applications of 50 milliampere minutes each were given to the spine; three applications of 50 milliampere minutes each to the upper end of each femur and the inguinal region, and two applications of the same duration to the upper end of each humerus.

August 13th, 100 mg. of radium element were applied to the three areas for six hours each, making a total of 1800 milligram hours of radium element.

August 20th, the same treatment was given to spine, femur, and humerus as on August 6th.

August 27th, eleven Roentgen rays of 75 milliampere minutes each were applied to the posterior chest.

September 5th the same treatment as on August 6th was given to spine, femur, and humerus.

September 15th, 100 mg. of radium element were applied to three areas for four hours each, making a total of 1200 milligram hours of radium element.

October 5th the same treatment as on August 6th was given to spine, femur, and humerus.

Today you see a widely different picture from the one previously described in this history (Fig. 475, 2). The tumor of the breast is smaller, well localized, and freely movable; the ulcer is about one-third the original size, dry, and almost entirely healed. The mass in the axilla is reduced about one-third and is freely movable. The infiltration of the surrounding breast areas and the swelling of the arm have disappeared. There are no palpable glands in the infraclavicular region. The patient's health has greatly improved; she has gained 8 pounds in weight; the pain in the arm disappeared completely after the third raying and she has since been able to sleep without an anodyne.

Although this patient should have had a radical operation when the tumor first made its appearance, she is still an "early" case, because she is of the "spare" type, with no loose fatty tissue. It was Dr. John B. Murphy's[1] teaching that "this spare type has a tendency to the production of connective tissue for the encapsulation of the malignant cells, holding them localized for a long period of time, so that the chances for recurrence are comparatively slight." The malignant cells in this case have not passed out of the lymphatics of the axilla and infraclavicular regions; the supraclavicular region appears to be free from the disease, and radiographs of the long bones, the spinal column, and the thorax show no metastases. Furthermore, the prognosis in this case is good because she is of the cancer age (between thirty-five and sixty); the lymphatics at this age are not so large and active as in the younger patients.

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[1] Clinics of John B. Murphy, M. D., Vol. III, No. 1, p. 188.

When operating on patients at the stage of extensive glandular involvement and ulceration we prefer to use the electrocautery knife instead of the steel knife, because it lessens the danger of dissemination by knife implantation. The cautery immediately seals the blood- and lymph-vessels which carry the metastases and the heat kills the cancerous products.

Dr. A. J. Ochsner has used the cautery knife together with soldering irons in these advanced cases for a good many years. One case operated sixteen years ago consulted him in this clinic a few days ago for some minor trouble, stating that she had been well since operation. There is no sign of recurrence.

Operation.—The patient was given a hypodermic of morphin sulphate, gr. $\frac{1}{4}$, and atropin, gr. $\frac{1}{100}$, one-half hour ago. The morphin is given to prolong the anesthesia after cessation of the ether, which is the anesthetic used; the atropin, to prevent inhalation pneumonia due to accumulation of mucus in the pharynx. With the patient in the recumbent position the ether is slowly and gradually given to complete anesthesia. This requires twenty to thirty minutes by the drop method. We now raise the head of the table, as recommended by Dr. A. J. Ochsner in his goiter operations, to an angle of about 45 degrees, which, as he says, produces anemia of the brain, serving to make the anesthetic received effectual during operation. We do this because we cannot continue with ether in the presence of the hot cautery knife on account of its combustibility. Before beginning cauterization the ether should be removed and the face

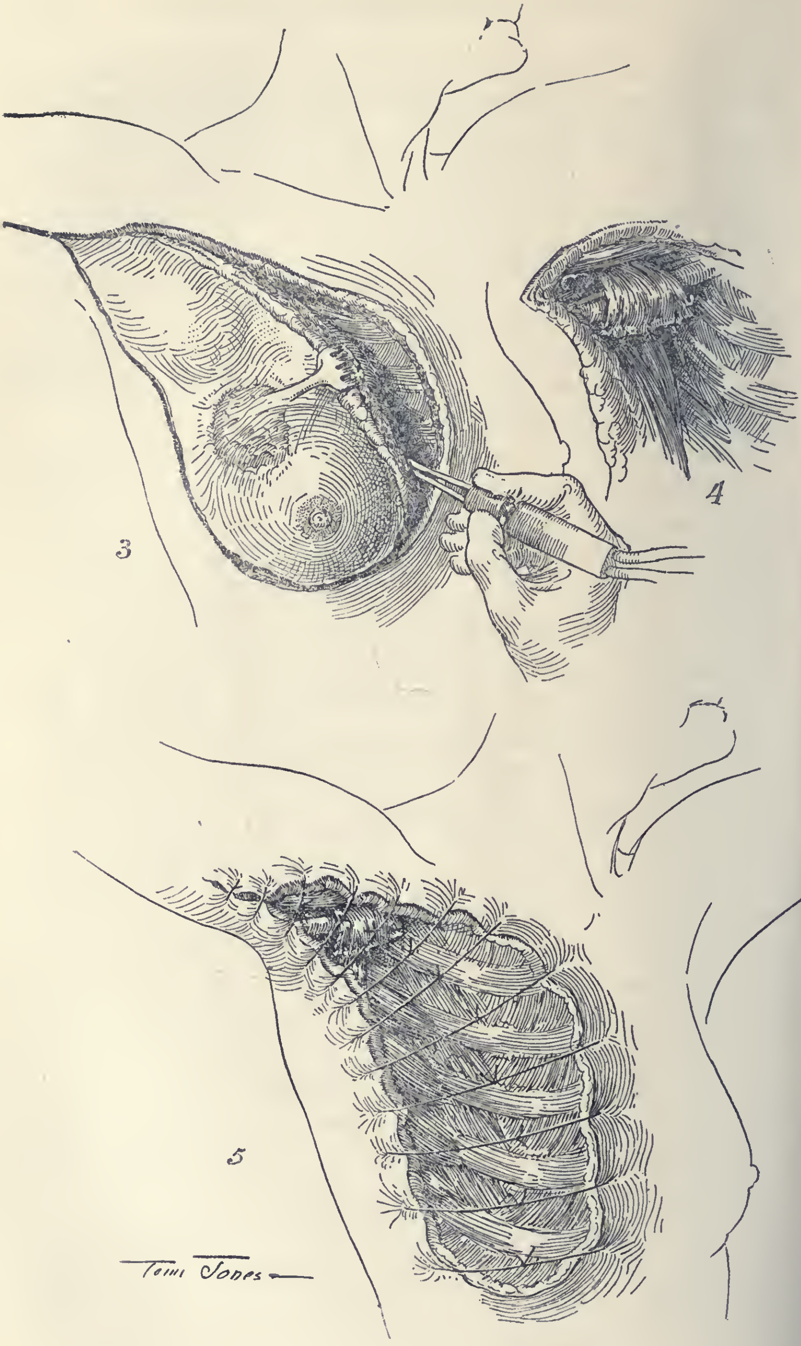

Fig. 476.

covered with a wet towel to prevent ignition of exhaled ether. Should it become necessary to re-anesthetize, lower the head and be sure to remove the cautery knife.

The technic which we are using in this clinic is the following:

The line of incision is marked out on the iodin-coated skin by means of an applicator moistened in alcohol; this removes the iodin and leaves a line to be followed by the cautery knife. We plan our incision with a view to removing all skin tissue which may possibly be carcinomatous, regardless of the possibility or impossibility of coaptation afterward. There is little danger of removing too much, but there is great danger of removing too little. In the cases where metastases have occurred, necessitating extensive removal of the integument, no attempt should be made to close the wound by traction. Either it should be allowed to close by epithelization or skin-grafting should be resorted to later. We should, however, use all available skin free from cancer to the best advantage in closing the axilla, but in this case it is necessary to remove not only the entire skin of the axilla, but considerable skin of the arm as well. This would bring the scar directly over the axillary vessels, and our patient would be in the same lamentable condition she was before receiving the Roentgen rays. The scar pressing on the axillary vessels and nerves would produce pain and edema of the arm. To prevent this we use the pectoralis minor muscle to cover the vessels. This method was introduced into this clinic fifteen years ago by Dr. Nelson M. Percy.

The electrocautery knife is heated to a "white" heat and the integument is divided along the line of incision. This is the only time during the entire operation that a "white" heat is required, but owing to the toughness of the integument a lesser degree of heat will not divide it. The lesser, or "cherry red" heat, is preferred in the deeper tissues, for the reason that the "white" heat is very destructive, and if used in the axilla, where the arteries and nerves are in close proximity to the disease,

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Fig. 476.—3, Removal of cancerous tissues *en masse* with electric cautery, beginning dissection at the sternum; 4, stump of pectoralis minor muscle utilized to cover axillary structures; 5, operation completed.

there is great danger of their destruction; furthermore, the "white" heat cuts the blood-vessels, causing hemorrhage, whereas the "cherry-red" heat seals them, preventing hemorrhage and metastases. The heat is gauged by holding the parts that are to be removed with the free gloved hand and keeping it close to the cautery knife.

We begin the removal at the sternum in this case simply because it facilitates the dissection (Fig. 476, 3). When using the electrocautery it is immaterial whether you begin at the sternum or at the axilla, hemorrhage and metastases being prevented by its use, whereas, when the steel knife is used, the better technic is to begin at the axilla. By so doing you ligate the vessels at their trunks and thus prevent cutting and recutting them after they have divided into many branches, as is the case when you begin at the sternum, causing hemorrhage and shock. We remove the entire pectoralis major muscle as well as the fascia of the upper portion of the anterior sheaths of both recti muscles, care being taken not to go through the intercostal spaces with the cautery knife, thus injuring the pleura, lungs, or pericardium. We then separate the pectoralis minor muscle at its origin, turn it back, remove all glands, fat, and fascia from the axilla by gauze dissection, severing the vessels with the cautery knife, after which we cover the axillary vessels with the pectoralis minor muscle (Fig. 476, 4). The entire breast, nodules, fat, and fascia, are now removed, together with the sheaths covering the lower portion of the serratus magnus and the upper portion of the external oblique muscle, in one piece.

The skin edges are approximated at the arm without tension; the remainder of the wound cannot be approximated, but we continue our sutures across the entire field to prevent retraction and folding in of the flaps (Fig. 476, 5).

The wound is dressed with a sterile vaselin dressing which is not disturbed for forty-eight hours. At the second dressing the wound is gently cleansed, after which we will apply warm wet compresses of chlorazene solution, 0.25 per cent. These dressings are not allowed to dry, so as to prevent sticking. The dressings are changed daily until the wound is clean and free from all sloughs, the patient receiving at the same time postoperative x-ray treatments at intervals of two weeks, consisting of four courses of fourteen applications each, nine fields over the chest, two on each side of the neck, and one over the posterior axilla, each field receiving 75 milliampere minutes' treatment.

As soon as the wound is clean the compresses of chlorazene are discontinued and hot parresine is used as follows: The wound is first cleansed with chlorazene or boric acid solution, then dried with an electric hot-air drier, after which the entire wound as well as about 1 inch of the surrounding skin is sprayed evenly with hot parresine, covering the whole surface with pieces of lace mesh, each piece measuring about 4 x 6 inches. These pieces of lace mesh are thickly covered with hot parresine applied with a camel's-hair brush. A thin layer of cotton is then applied, and is, in turn, covered with hot parresine. The whole surface is covered with gauze and held in place by a gauze roller bandage. These dressings are changed every twenty-four to forty-eight hours, depending upon the amount of serous secretion present. The improvement in the condition of the wound is astonishing, epithelization takes place rapidly, and is not interfered with by the x-ray, as are skin-grafts.

CLINIC OF DR. EMMET A. PRINTY

Provident Hospital

CHOLELITHIASIS WITH CHRONIC EMPYEMA OF GALL-BLADDER: TECHNIC OF CHOLECYSTECTOMY

Summary: Detailed description of technic of cholecystectomy; importance of walling off pouch of Morrison; exposure of bile-ducts—method of isolating cystic duct and artery without endangering common duct or portal vein; exploration of the ducts—an original method of determining the patency of the common duct; ligation of stump of cystic duct—how to place a deep ligature.

The patient is a married woman aged fifty-one. She was admitted to the hospital complaining of dull pains of varying intensity in the right hypochondriac region, which sometimes radiated to the angle of the right scapula. There was some epigastric distress, with occasionally a slight feeling of nausea. The patient was not constipated, had never been jaundiced, and never had had any severe attacks of pain, except at one time, two weeks ago, when she had a brief attack with sharp and severe colicky pains in the right upper quadrant.

Family and past histories were negative.

Physical examination showed marked tenderness over upper right rectus at costal margin, and upper part of muscle was very rigid. A tumor-like mass could be palpated in gall-bladder region. Examination otherwise negative.

Temperature normal; white count, 8600.

A diagnosis was made of gall-stones, with chronic empyema of gall-bladder. As the pain appeared to be subsiding, it was deemed wise to keep the patient at rest for a few days before undertaking radical surgical measures. She has now been under observation for ten days and we feel that the time is ripe for operation.

Operation.—We make this incision in the right rectus muscle, about 1 to 1½ inches from the midline. By making the incision medial to the outer third of the muscle (that is, anywhere in the medial two-thirds of the muscle) we avoid injuring those intercostal nerve branches and their accompanying vessels which enter the muscle usually about the junction of the outer and middle thirds. The incision extends from the costal margin to the level of the umbilicus. If the patient is very fat, or more room is required, we curve upward along the rib margin to the tip of the ensiform, cutting the skin and fat only. This enables us to retract widely the cutaneous and fat margins, and aids in decreasing the depth of the wound.

We have here a mass of adhesions between the ventral surface of the liver and the omentum, colon, and duodenum. The gall-bladder cannot be seen (Fig. 477). However, we can soon locate the region in which it should be. Here you see a deep cleft in the liver margin, which indicates the "notch for the round and falciform ligaments." As we pass our finger along the liver margin to the right of this first notch, we reach another depression or concavity, which corresponds to the gall-bladder region. We begin to free this locality from its adhesions and soon isolate the gall-bladder. This is done gently, to avoid injuring the viscera and to avoid hemorrhage. We are working now with the finger from below up, as the adhesions seem to separate easier this way. If you find the line of cleavage, you have little trouble in the average case. The tissues are thickened and edematous, and the fundus of the gall-bladder is covered with a shaggy, brownish-yellow exudate. The gall-bladder is very thick walled and distended. This patient has been having an acute exacerbation of a chronic disturbance, and one would have expected the symptoms and findings to have been more pronounced. The previous history also contains no indications of any of the disturbances we would expect from such a condition.

The lymph-glands here are also enlarged. The head of the pancreas is also somewhat larger and harder than normal. We now proceed to wall off the field of operation with sponges. There is no necessity in this case of rotating the liver on its vertical axis or of depressing it. However, in some cases it is of great advantage to do this, maintaining the position by placing sponges above and posterior to the right lobe. We are placing a pack between the right kidney and the corresponding liver surface; as free fluids gravitate to this pocket—the pouch of Morrison—when the patient is in the recumbent position, we are very careful to place sponges in it before working on the gall-bladder or ducts. This is also a place which we must drain well in cases of ruptured gall-bladder or perforated duodenal or

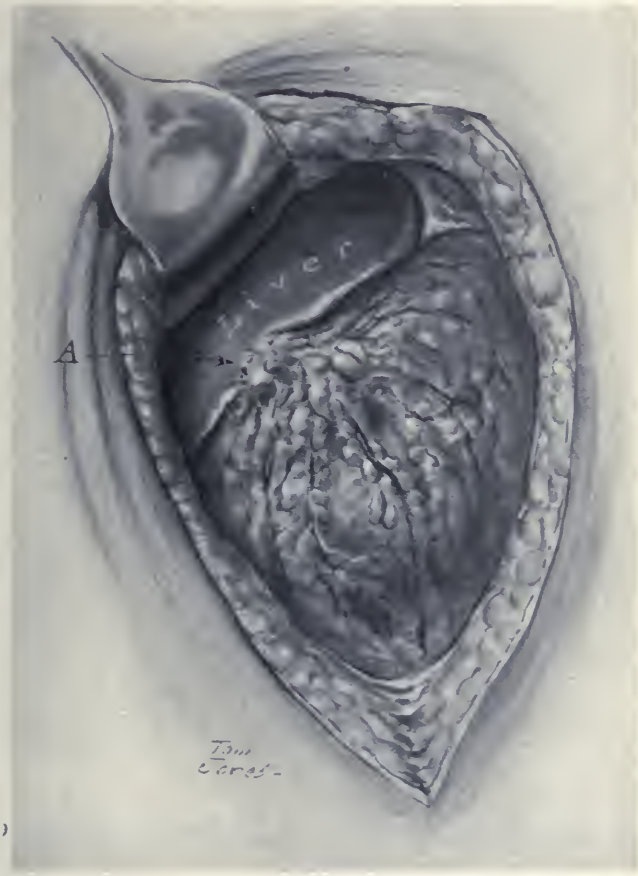

Fig. 477.—Mass of adhesions in gall-bladder region (*A*) brought into view upon retraction of edges of abdominal incision.

gastric ulcer, and preferably through a lumbar stab-wound, in front of the right kidney. This, or another sponge, can be made to close off the epiploic foramen (Winslow's) and prevent contamination of the lesser peritoneal cavity. Another sponge is placed between the stomach and left lobe of the liver. Other sponges keep back the intestines and colon, and cover over the pylorus and upper duodenum. The gall-bladder and hepatico-duodenal ligament (containing the ducts, etc.) are now surrounded by sponges, which not only protect the surroundings from contamination, but are a great help in isolating the field of operation when rightly placed.

This gall-bladder is distended with pus and stones. The wall is greatly thickened and there is marked pericholecystitis. The ducts and their surrounding tissues are thick and enlarged. No stones can be palpated in the ducts. It is possible that none have ever passed out of the gall-bladder. This would account for the absence of acute attacks in the present or previous history.

The only thing to do with this gall-bladder is to take it out. If the gall-bladder walls were thin and there was danger of rupture during removal we would first aspirate and remove the contents. This also often facilitates the removal and allows one to get at the cystic duct better.

In our cholecystectomies we endeavor, when practical, to remove the gall-bladder from below upward. This gives better hemostasis primarily, and also prevents any small stones or pus from passing out of the gall-bladder into the ducts during our manipulations. In some cases where the neck of the gall-bladder and the ducts are surrounded by dense adhesions, or the ducts seem to be anomalous, or the exact relationship is not clear, it is better to start the removal at the fundus and work downward, until we have the gall-bladder detached except for the pedicle consisting of cystic duct and artery. These are then clamped. In other cases we sometimes find it advisable first to clamp below, for the reasons given, and then dissect from the fundus downward, thus combining the two methods. Then, before cutting the pedicle, we can make sure that we are within safe limits.

This forceps which we had placed on the so-called "pelvis" of the gall-bladder lifts up the pouch or dependent portion of the gall-bladder in this region and gives us a clearer view of the duct region (Fig. 478). It also puts the cystic duct on tension and the common duct somewhat, and facilitates palpation. It is very important to recognize clearly the duct arrangement in the individual case before placing any clamp or ligature. The majority of common and hepatic duct injuries are due to failure to recognize individual variations, and careless or hasty application of clamps. I have for several years followed a method in

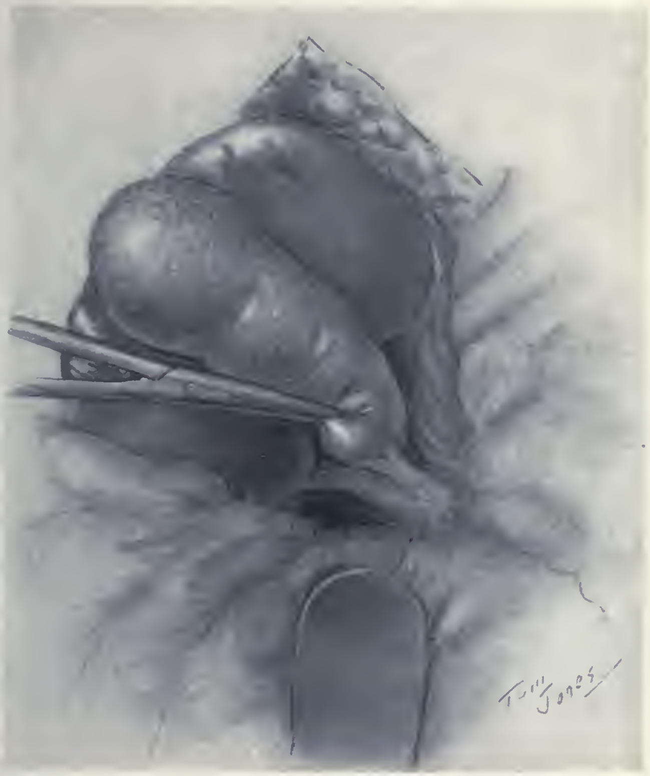

Fig. 478.—Gall-bladder freed from adhesions (note roughened peritoneal surface) and in the grasp of forceps in order to render the region of the ducts prominent. The entire area has been thoroughly walled off by gauze pads.

placing the first clamp which I think eliminates some of the dangers of injury to other structures, and which also makes practically certain the inclusion of the cystic artery with the duct. If we call to mind the anatomy of this region, we can see the reasons for this method.

The cystic and common hepatic ducts usually join at an acute angle to form the common duct. The former ducts are generally in close proximity, but when the cystic duct is pulled forward and to the right, the width of the angle between them is increased. The cystic artery (usually from the right branch of the hepatic) runs across this angle from left to right, and meeting the cystic duct or neck of the gall-bladder, passes up to the fundus, giving off its various branches (Fig. 479). Our success

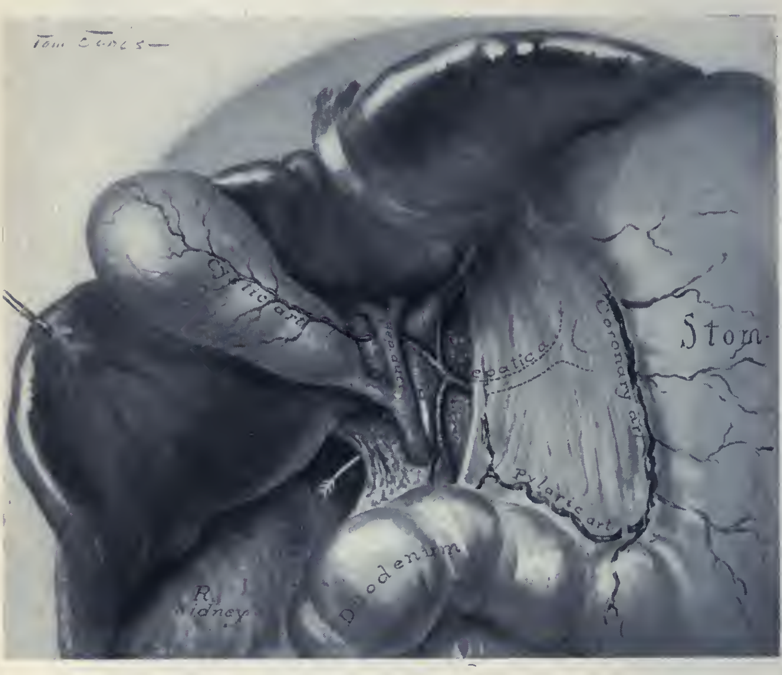

Fig. 479.—Anatomy of the region of the cystic duct; the cystic artery is represented in its usual location passing from left to right behind the hepatic duct and across the angle between the hepatic and cystic ducts to the gall-bladder.

in getting the artery and duct together in our clamps, if we are following the usual method of removal, will depend upon whether the artery meets the cystic duct early or late (Fig. 480). For this reason I always make it a point to first pass the clamp relatively high, that is, around the neck of the gall-bladder (Fig. 480, *A*). At this point the artery should be in relatively close apposition to the gall-bladder. Also, the only structures we can injure at this point are the liver and the gall-bladder; whereas, further down we are in danger of traumatizing or including in our clamp the hepatic duct, common duct, or the right branch of the hepatic artery, as it often passes in front of instead of behind the hepatic duct, and if small, it might be mistaken for the cystic artery, as I have noticed in some cases. I remember one case where inclusion of the right hepatic duct might have been an almost unavoidable error, were it not that the ducts showed rather plainly, and the method we use was followed. The left hepatic seemed to be the common hepatic, and the right hepatic and cystic were closely bound together (Fig. 481). The portal vein may also be injured.

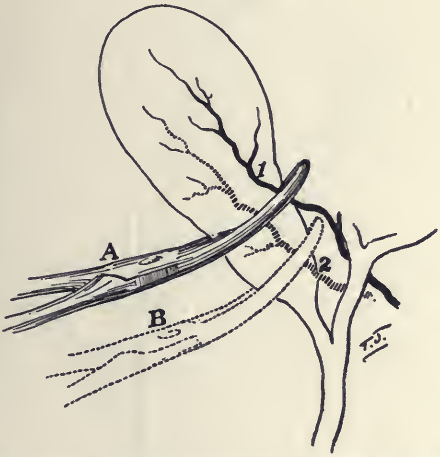

Fig. 480.—*A*, Forceps placed relatively high on the gall-bladder will always catch the cystic artery (1), which sometimes reaches the gall-bladder at a relatively high level; *B*, usual site for placing forceps and usual location (2) at which cystic artery reaches gall-bladder.

After placing the closed clamp between this portion of the gall-bladder (*i. e.*, the neck) and the liver, we separate the blades slightly. Then we withdraw the clamp sufficiently to place one blade behind and one in front of the upper duct, and then push the clamp downward to the proximal portion of the cystic duct. Our progress is arrested when we reach the point of junction of cystic and hepatic ducts, and there is no possibility of going too far, or of any other structures except the duct and vessels being in our clamp. We tighten the clamp then, keeping a slight distance above the termination of the duct, to avoid injuring the common or hepatic ducts with our clamp, or puckering or constricting them with our subsequent ligature. If the cystic duct were removed absolutely flush with the common duct there would naturally not be a suitable stump for ligating, and there would be some danger of puckering and interfering with the common duct. Also, the ligature could

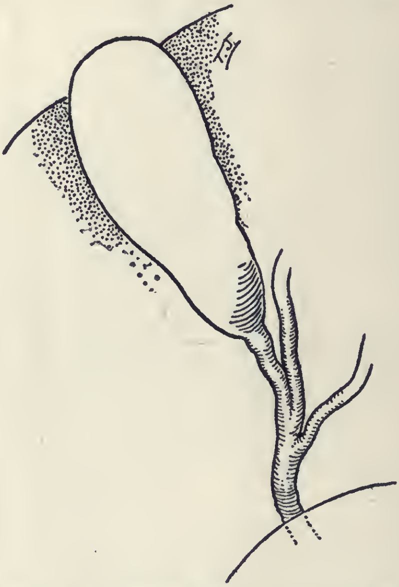

Fig. 481.—Diagram of conditions found in one case in which the cystic duct and right hepatic duct were in unusually close proximity and might have been ligated together; it is in such cases as this that careful, methodic technic proves its value.

easily slip off. In some cases we may find that we have left a rather long cystic stump. In that case it is an easy matter to pull up on the stump, and place our ligature closer to the common duct. Or, in cases where the anatomy is not sufficiently clear, or we have trouble in placing our clamps low down, we can first resect high up, and after getting the gall-bladder out of the way, remove the rest of the cystic duct.

If, in following this method, we encounter a case where the cystic duct is closely adherent to the liver, and the surrounding tissues are very dense, we make a primary incision through these tissues on either side of and parallel with the cystic duct, and thus facilitate the placing and subsequent manipulation of the forceps. In the ordinary case, however, we avoid as much as possible any unnecessary dissection or cutting until after the clamp is placed, and thus avoid bleeding or hematoma formation, which might render the relationships less distinct.

The remaining steps, as you see, consist of placing another clamp above the first, and cutting the duct, etc., between the two. Then, aided by traction, we separate the gall-bladder from its liver surface, after first incising the peritoneal reflection on either side. We avoid injuring the liver or opening the gall-bladder by careful dissection in the line of cleavage, and by not being in too much of a hurry. You notice that in some places this gall-bladder is very adherent to the liver. That is often the case, and usually at points where small veins from the gall-bladder are emptying directly into the liver. We often find cirrhotic or even necrotic areas in the liver at these points.

The attachment here at the fundus we clamp before cutting and then ligate. The ligature is left long, and will later be used to fasten our split drainage-tube to the liver. In this case we are unable to leave sufficient peritoneal flaps to suture across the denuded liver surface. However, the surface is dry and fairly smooth. If we feared extensive visceral adhesions to this area, we could combat them by following Andrews' method of colohepatopexy.

We have not yet ligated the stump, because we intend to explore the ducts. This is a case which certainly demands exploration, even though there have been no symptoms of common duct obstruction, or any stones felt on palpation. Many times though we fail to feel stones which are actually present, and especially when they lie in the retroduodenal portion of the duct. So we will save ourselves and the patient future trouble by making sure that none are left behind. You will notice that we did not cut the cystic duct across flush with the clamp. These duct edges can now be grasped with fine forceps. We then grasp the tissues on the superior and medial aspect of the duct with another forceps, as this is where the artery usually lies, or we can ligate the artery now. Sometimes we can see its cut end in the first clamp. Now we can remove our initial clamp with little danger of hemorrhage, and we are ready to explore the duct. If the lumen is narrow, or if we wish to insert a drainage-tube, we usually split the stump down to the common duct. We are introducing a probe, which we bend to suit the curve. It passes up well into the hepatic duct. We meet with an obstruction in the lower portion of the common duct. This is probably due to the probe becoming engaged in a mucous fold. A method which I have used for several years consists of washing out the duct when the probe will not pass, and when we wish to make sure there is no obstruction either from stone or from inflammatory swelling. We would not ligate the stump if inflammatory obstruction existed, but would drain the duct. Also, if one intends to close the abdominal wound without drainage after simple cholecystectomy, as advocated by Willis, we should make sure of the absolute patency of the duct. We now press the point of a large glass syringe into the cystic stump. Then, placing a finger on the hepatic duct with sufficient pressure to prevent the saline solution from passing up to the liver, we gently force the fluid into the duodenum through the common duct (Fig. 482). Very little pressure should be used, merely enough to overcome the sphincter, as otherwise there would be some danger of forcing some of the fluid into the pancreatic duct. If much resistance is encountered, it is best not to try to force it, as we know that pancreatitis can be induced in this way experimentally. In a case of this kind, where the gall-bladder has not been functionating and the common duct is dilated, the sphincter resistance is practically nil. You see

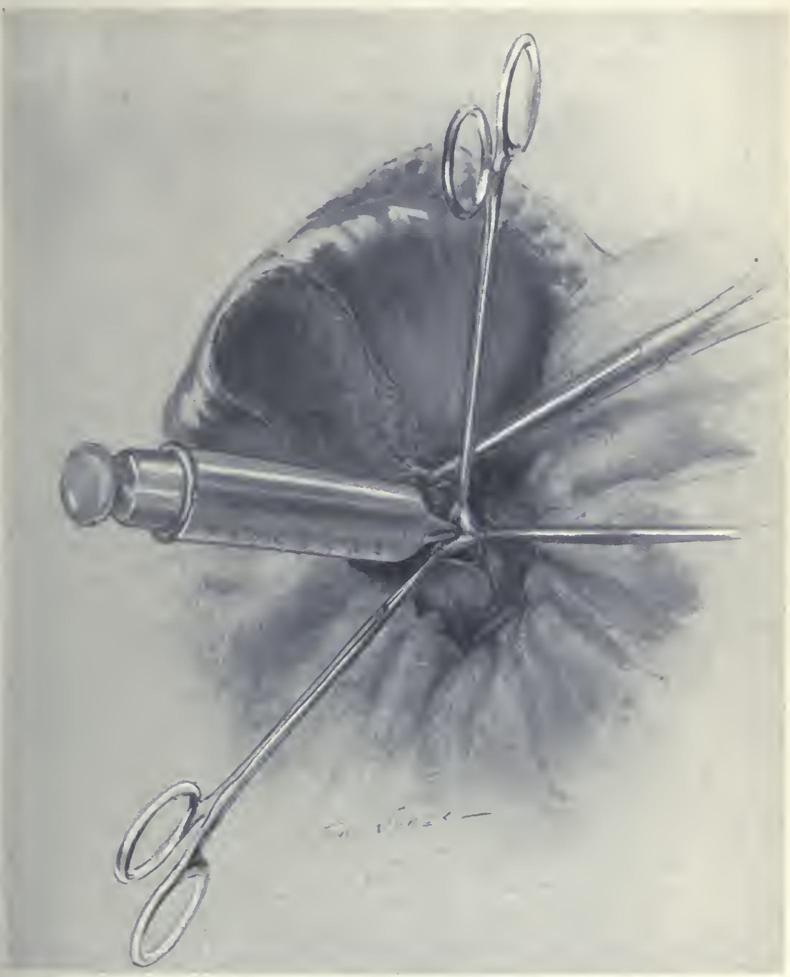

Fig. 482.—Injection of liquid into common duct as a means of proving its patency and of washing out pus and fragments of calculi.

that the solution used is easily passing into the duodenum, with practically no pressure. Therefore, there is no obstruction. The advantages of this procedure are that we can determine patency, as the solution will pass through when a probe might not, and also we wash out of the duct any pus, stone fragments, or detritus which may be present. The only possible danger is the theoretic one previously mentioned. In some instances, as I have demonstrated anatomically, the manner of junction of the common duct and main pancreatic duct serves to establish a valve arrangement which aids in preventing the entrance of bile into the pancreatic duct. There has been no trouble in the cases in which I have done this. We sometimes with the syringe aspirate contents from the ducts, especially the hepatic, for obvious reasons.

I have for some time considered the advisability of having a slender, suitably curved instrument constructed to pass through the common duct into the duodenum, for the purpose of dilating the orifice and stretching, and if possible paralyzing, the sphincter. This would obviate the dilatation of the ducts, with back-pressure in the biliary system of the liver, and possibly in the pancreatic ducts, which follows a cholecystectomy and which is dependent upon the integrity of the sphincter of Oddi. Also, this should decrease the liability of leakage from the cystic stump when the latter has been ligated.

We now ligate the stump, including the artery. I am placing this ligature according to a method which is a great help when placing a deep ligature, as in the pelvis, throat, etc., and in some gall-bladder cases. We place the ligature (No. 2 chromic gut) around the forceps and tie a surgeon's knot. The short end is to our right. We grasp the loop lightly with a forceps and hold the long end in our left hand (Fig. 483, 1). The forceps now carries the loop down to and over the curved tip of the clamp on the duct. We release the loop and grasp the short end with the forceps and with a sawing motion tighten this loop (Fig. 483, 2). The index-finger of the left hand is now used to make sure that our loop is sufficiently tight. We now bring the short end behind the cystic clamp from right to left and tie a complete knot, while the assistant turns the clamp toward the left, so as to expose this portion of the stump (Fig. 484, 3). This has the effect and security of a double ligature. We hold the ligature

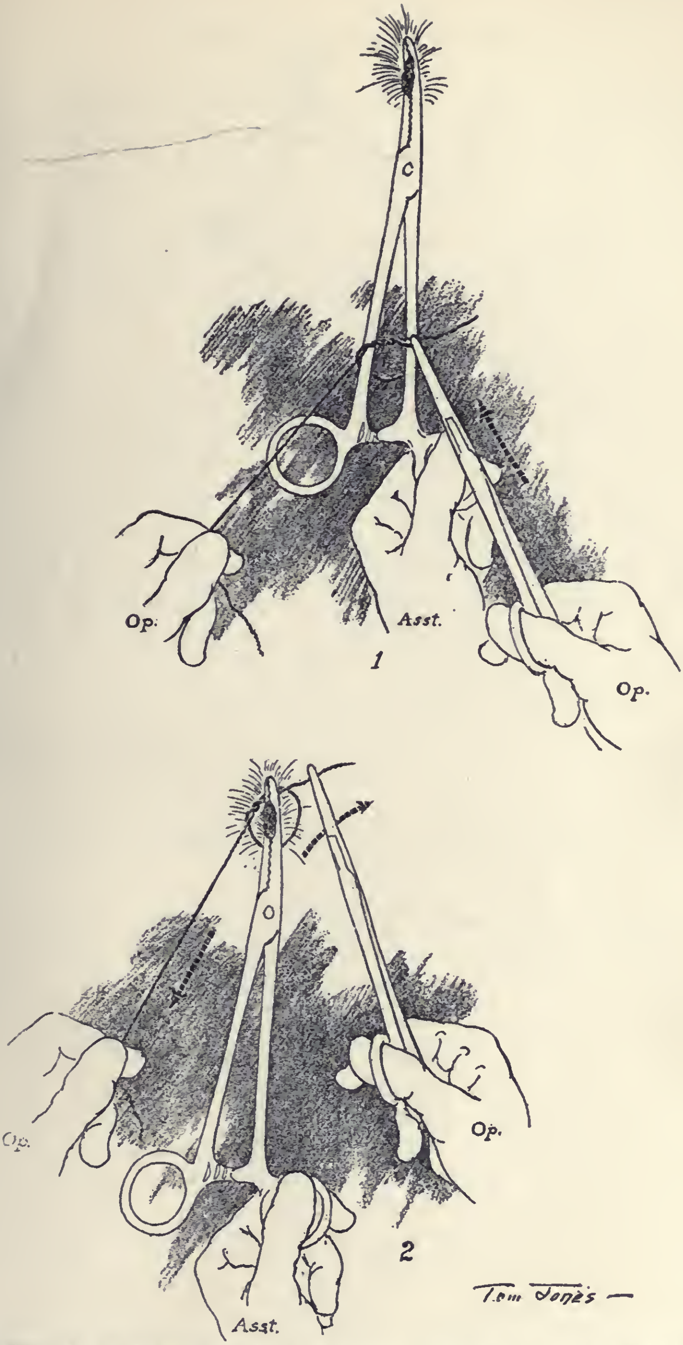

Fig. 483.—A convenient method for placing ligatures in regions which are difficult of access.

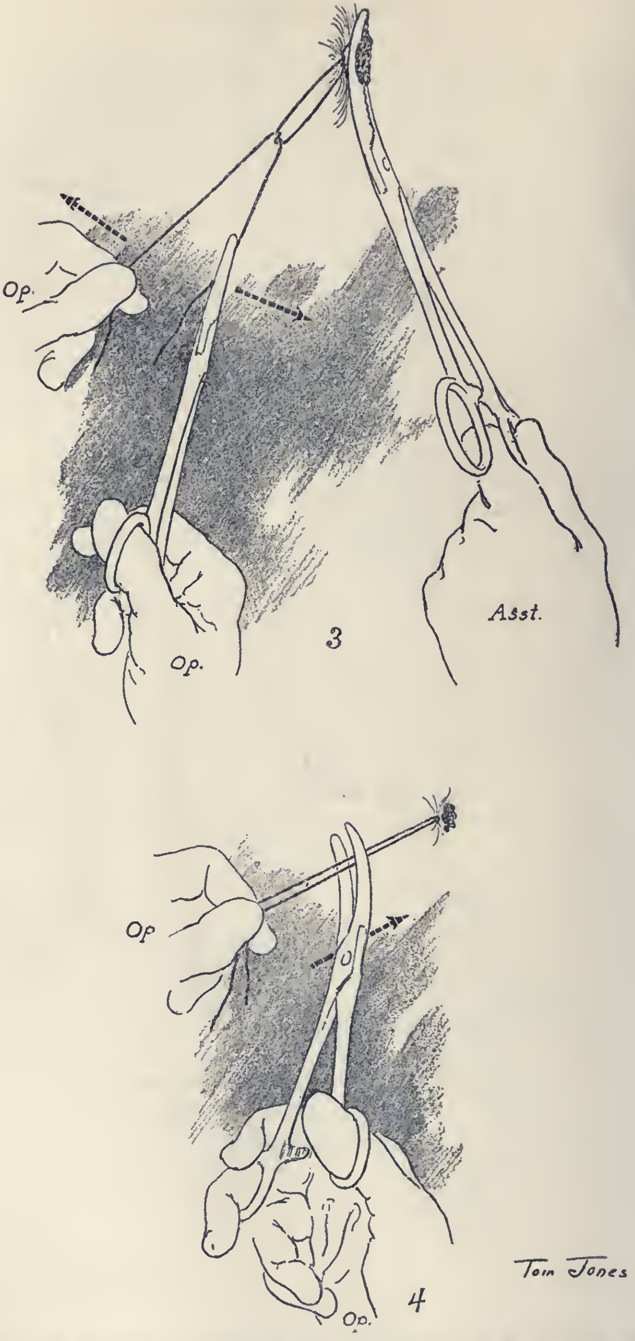

Fig. 484.—A convenient method for placing ligatures in regions which are difficult of access.

ends loosely, while we remove the cystic clamp. If there should be any bleeding, or leakage of bile, our ligature acts as a guide to the stump (Fig. 484, 4). You notice it is perfectly secure, so we cut off the ends of the ligature. We have found this a very handy method, and it can be used in very narrow and deep wounds. In the case of a large thick stump we often anchor our ligature to the stump before tying, so as to prevent the ligature slipping.

This stump has been touched with phenol and alcohol and we leave it without further treatment. This split tube is placed down to the duct, but not anchored to it. We also place a small cigarette drain in the kidney pouch, as there was more or less seropurulent exudate encountered while freeing the adhesions.

There was no indication here for common duct drainage, such as cholangitic symptoms, jaundice, etc. We close the abdomen in our routine way, using the preliminary mattress sutures in closing the first layer, as described in the Surgical Clinics of Chicago, Vol. II, No. 5, p. 989, October, 1918. The drains are brought out through the upper part of the incision, but not too close to the rib margin.

This patient should make an uneventful recovery, although we anticipate some drainage from the surrounding infected tissues.

Postoperative Notes.—The patient made an uneventful recovery. Drainage was primarily rather free, but decreased daily. Drain was removed on the tenth day.

CLINIC OF DRS. DANIEL N. EISENDRATH AND MAURICE L. GOODKIND

MICHAEL REESE HOSPITAL

SUBACUTE PANCREATITIS (PANCREATIC ABSCESS)

Summary: Diagnosis and operation on patient with subacute pancreatitis; varieties of pancreatitis producing acute symptoms—definition of terms; discussion of the etiology, differential diagnosis, and treatment of the different clinical types.

ACUTE pancreatitis has until recently been regarded as a disease in which surgical intervention was contraindicated because the impression prevailed that the condition was one which pursued a fulminant course toward an almost inevitably fatal outcome. This impression was due to the fact that practically every case which was seen clinically belonged to the hyperacute or, as we now prefer to call it, acute form. The diagnosis was seldom made before operation, and the patient was usually seen at a time when toxemia was so profound that death either occurred during the operation or very shortly afterward. In cases not operated upon the patients were seen in a moribund condition and it was only at the autopsy table that the diagnosis of the cause of such a grave clinical picture was made. A little later we began to recognize or, rather, suspect the existence of these acute cases at a period in their development when operative interference was still to be considered as promising at least a fair percentage of recoveries, and reports of series of successful operations began to appear which greatly surprised those who had felt rather pessimistic about the advisablity of operation. Quite recently the situation has become still more clarified.

The cases which had been formerly operated upon with such a high percentage of mortality have been found to belong to the most virulent or fulminant type of acute pancreatitis in which most extensive necrosis and hemorrhage go hand in hand. That even these cases are amenable to surgical treatment if recognized early enough is well shown in the reports of Deaver,[1] Linder,[2] and Watts,[3] to which we shall refer again. We have begun to recognize, during the past few years, a type of the disease in which the symptoms are not as grave nor the course as fulminant as in the very acute type. To this clinical form the term "subacute pancreatitis" or "pancreatic abscess" has been given. Our patient of today's clinic belongs in this group. After we have presented the principal features of the clinical history we will discuss the subject of acute and subacute pancreatitis, especially the clinical recognition and treatment of a condition formerly regarded as so discouraging in its operative results.

History of Case.—The patient, a man of thirty-four years, became suddenly ill three weeks before admission to the hospital. The first symptoms were severe, agonizing pain in the upper abdomen on both sides of the median line, accompanied by vomiting. The abdomen became distended and there was marked tenderness and rigidity over its upper half.

He was attended at his bome by a physician and was not seen by us until the end of the third week. At this time he seemed extremely ill, one of the most striking features being the dark reddish-blue color of the skin of the face.

The leukocyte count was 17,000; temperature, 102° F. (rectal); pulse, 130. Examination of the abdomen revealed moderate general distention with marked tenderness in both upper quadrants. The rigidity was board-like in the left, but only moderate in the right upper quadrant (Fig. 485, 1). The previous history of the patient did not throw any light on the nature of the present trouble. There were no symptoms pointing to gall-bladder disease or to a duodenal or gastric ulcer. *x*-Ray examination showed normal contours and positions of both halves of the diaphragm.

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[1] Jour. Amer. Med. Assoc., August 11, 1917, 69, 434.

[2] Ibid., September 1, 1917, 69, 718.

[3] Annals of Surgery, 1918, 67, 278.

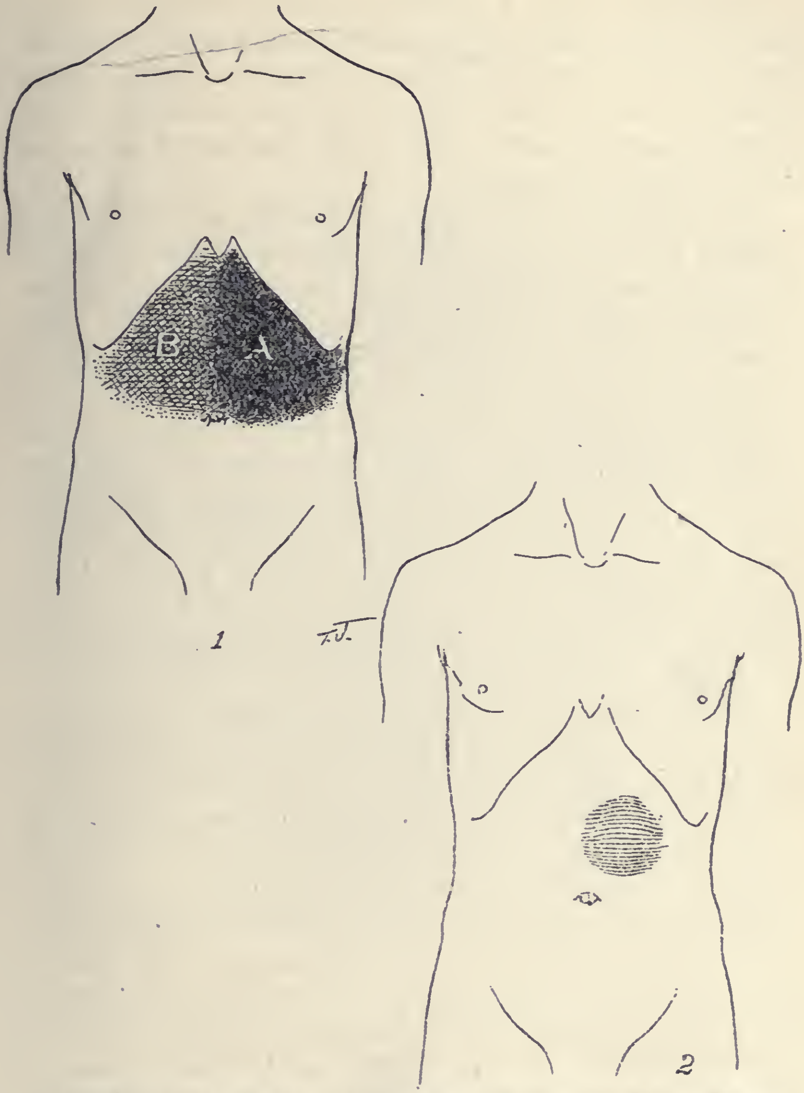

Fig. 485.—1, The dark area (*A*) represents the extent of the intense rigidity and tenderness in the left upper quadrant. The lighter area corresponds in extent to the slighter rigidity and tenderness in the right upper quadrant; 2, shaded area showing location of the mass, or localized resistance, felt after patient was anesthetized.

The clear area just beneath the left dome of the diaphragm due to the "gas bubble" of the stomach was present. We were thus able to exclude a subphrenic abscess due to perforation of a gastric or duodenal ulcer, especially as the movements of the diaphragm as seen during a fluoroscopic examination showed no devitation from the normal.

The sudden onset with severe epigastric pain and vomiting followed by symptoms of extreme toxemia without a marked rise in temperature or white blood count and the presence of the exquisitely tender and extremely rigid area in the left upper quadrant led us to suspect the presence of a pancreatic abscess (subacute pancreatitis). The urine was negative, as one would expect, because glycosuria is rarely if ever a symptom of acute affections of the pancreas. The examination of the stools also failed to be of aid. We have learned from repeated observations that the Cammidge reaction is of no value even in chronic pancreatitis. Undigested meat-fibers or fatty stools are rarely of any assistance from a diagnostic standpoint in acute pancreatitis, since these are usually found in the chronic forms of the disease.

Our diagnosis before operation rested between subacute pancreatitis and perforation of a gastric ulcer with formation of an abscess between the stomach and the anterior abdominal wall.

Under anesthesia we felt a mass (Fig. 485, 2) or localized resistance to the left of the median line midway between the umbilicus and costal arch. An incision was made through the left rectus muscle directly over this area. Upon opening the peritoneal cavity the gastrocolic portion of the omentum was found adherent to the parietal peritoneum at the lower two-thirds of the incision, while at the upper third, the stomach, which was not adherent, presented. Two small white areas of fat necrosis on the surface of the bulging adherent omentum confirmed the diagnosis of some acute or subacute pancreatic involvement (Fig. 486). The anterior wall of the stomach was sutured to the parietal peritoneum, thus walling off the general peritoneal cavity. An incision was then made through the gastrocolic omentum and an artery forceps inserted (Figs. 486, 487). Upon spreading its blades, a large quantity of turbid fluid, like dirty dishwater, containing many flocculi of whitish material, escaped. Digital examination of the cavity from which this fluid came revealed the fact that it was behind the stomach and its posterior wall formed by the greatly swollen and softened pancreas. A large rubber tube was inserted (Fig. 487) and the abdominal incision closed around it. Cultures taken from the fluid remained sterile.

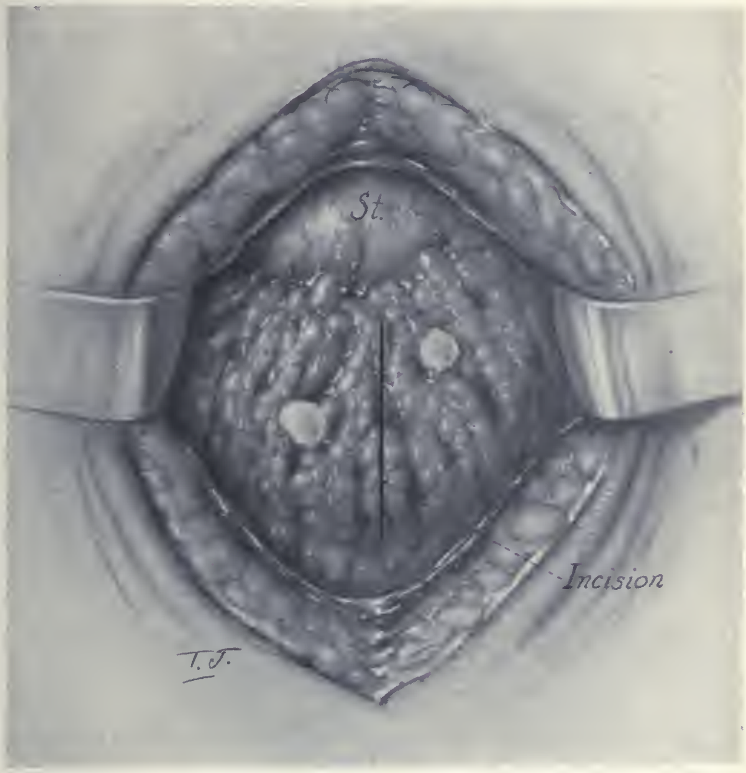

Fig. 486.—Incision made in the bulging gastrocolic omentum. Note the two white spots corresponding to areas of fat necrosis, so characteristic of acute pancreatitis. The white color is the result of the action of the pancreatic fat-splitting ferment upon the omental fat, with saponification of the latter.

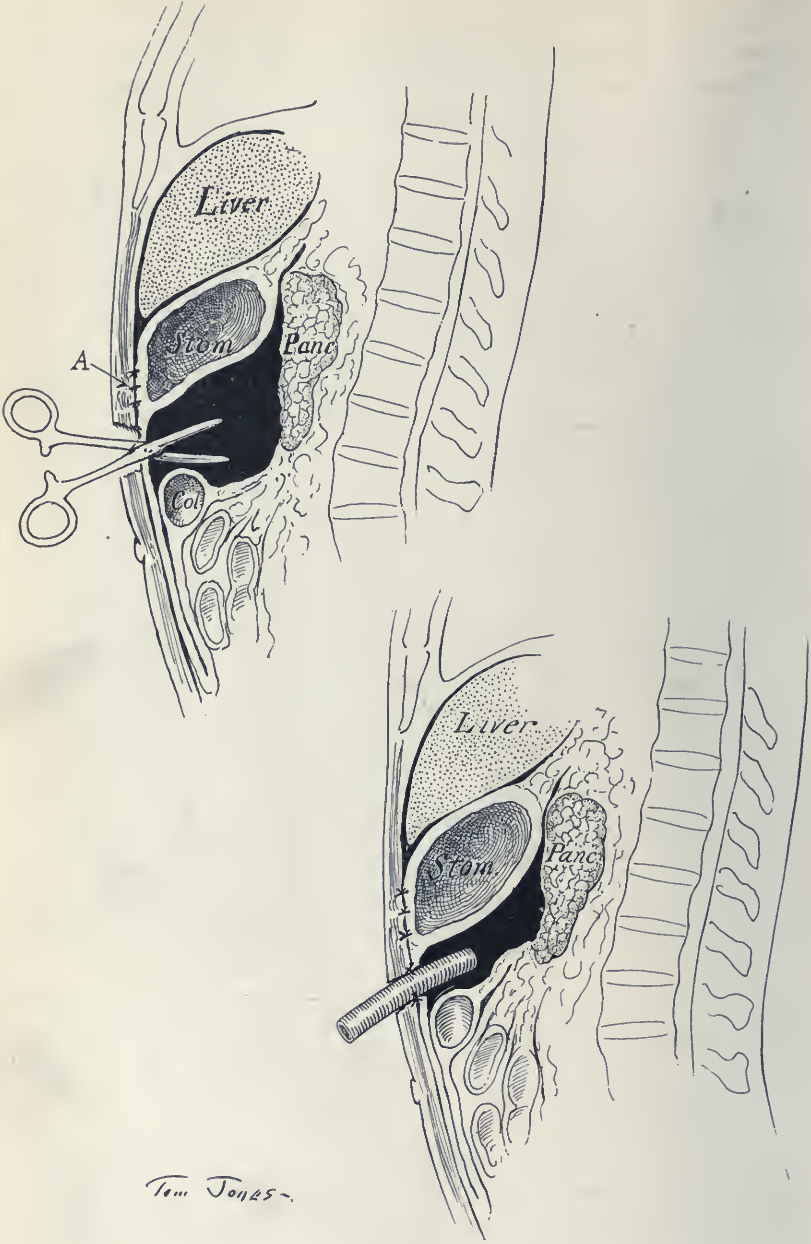

Fig. 487

Archibald[1] states that the pancreas is rarely the seat of a bacterial inflammation. Cultures from all but the frank abscesses, which are rare, are usually sterile. Even from some of the abscesses the cultures are sterile, so it is not surprising to have this finding in our case.

Chemical examination of the fluid showed that it was of pancreatic origin.

During his convalescence this patient had at one time a recurrence of his former symptoms which required prolonged drainage of the abscess cavity. He has resumed his former occupation and appears perfectly well today.

DISCUSSION OF ACUTE AND SUBACUTE PANCREATITIS

Opie and Meakins have shown that the real lesion in acute pancreatitis is necrosis of the cells of the parenchyma. Hemorrhage (which is such an important feature of the pathologic changes in the fulminant type of the disease), gangrene, and suppuration are merely complications and may not appear at all. Extensive necrosis may result in sloughing of the greater portion of the organ. Infection of the necrotic area may result in abscess formation.

In the etiology of the condition the most important sources are the following:

1. Infections of the biliary tract. This is the theory of Maugeret, supported by Arnsperger and Deaver. Infection travels, according to this view, by way of the lymphatics. Archibald does not believe in this retrograde route because the pancreas is rarely the seat of a bacterial inflammation, cultures, as was stated above, being usually sterile.

2. Hematogenous route. This theory is held by some who

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[1] Surgery, Gynecology, and Obstetrics, 1918, 28, 529.

Fig. 487.—In the upper figure the method employed in opening the pancreatic abscess is shown. After making an incision through the bulging gastrocolic omentum (Fig. 486) an artery forceps was inserted and its blades spread. Note at *A* sutures between the stomach and the parietal peritoneum. In the lower figure a drainage-tube has been introduced into the abscess cavity through the incision in the gastrocolic omentum.

believe that acute pancreatitis occurring during mumps, typhoid, etc., can best be explained upon this basis.

3. The necrosis is the result of the direct action of the bile salts, and it is not necessary to assume an activation of the normal pancreatic ferments. This is the theory of Opie, Flexner, and Archibald. The latter has recently[1] published experiments in which he produced acute and subacute hemorrhagic pancreatitis by forcing infected bile into the pancreatic duct. The sphincter of Oddi at the ampulla of Vater plays an important direct rôle by increasing the intraductal pressure. The extent of the pancreatic necrosis is determined at the onset by the grade of virulence and extent of permeation of the noxious agent.

It is of interest to clinicians in connection with this last theory that three conditions must be present before actual damage will be done: first, a change in bile composition increasing the proportion of bile salts; second, undue resistance, perhaps resulting from spasm of the common duct sphincter, and third, abnormal rise of the pressure in the biliary system. Gall-stones probably bring about an increase in bile salts, and in infected bile it is rather the chemical change produced by the action of bacterial growth than the bacteria in their infecting capacity that causes the pancreatic lesion, according to Archibald.

CLINICAL TYPES

I. **Acute Pancreatitis** (Called by Deaver "Ultra-acute").—The most important symptoms are: (*a*) Extreme toxemia, as evidenced by cyanosis, rapid small pulse, cold clammy sweat, shallow respiration, and subnormal temperature. (*b*) Severe epigastric pain. Tenderness and rigidity are not marked in these acute cases, and may be absent. Vomiting is a prominent symptom. Glycosuria appears so late as to be of little value in the diagnosis of the very acute cases.

The onset is very sudden, the first symptom being the severe epigastric pain followed rapidly by the symptoms of collapse or shock due to the toxemia.

In the differential diagnosis of the acute fulminant cases we must consider: (1) Perforation of the gall-bladder, or of a gastric or duodenal ulcer. In these, board-like rigidity is an early symptom. The initial pain is, as a rule, not as severe, and the symptoms of toxemia develop much more slowly than in pancreatitis. There is, in addition, often a history of preceding ulcer or gall-bladder trouble.

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[1] Vide supra.

(2) Ileus. The vomiting in ileus recurs at frequent intervals, abdominal distention occurs earlier, and the vomiting within twenty-four to thirty-six hours becomes stercoraceous.

(3 and 4) Mesenteric embolism and thrombosis and acute gall-bladder infection must also be considered, but their differentiation is a much easier task.

II. **Subacute Pancreatitis or Pancreatic Abscess.**—The onset is quite similar to that observed in the acute type, but it is not as severe, and the subsequent symptoms are also greatly modified in their intensity.

After the subsidence of the initial severe symptoms, however, the toxemia persists, the patient still appears extremely ill, and the appearance of fever with leukocytosis and of rigidity and tenderness in the epigastrium serve to indicate a localization of the process.

TREATMENT

1. **Acute Cases.**—As we stated at the beginning of this lecture, the acute cases (ultra-acute of Deaver) were formerly regarded as hopeless. In the first series of 16 consecutive cases reported by Linder[1] operated to June, 1915, the mortality was 62.5 per cent. In the second series of 15 cases since June, 1915, the diagnosis having been made in 75 per cent., there was a mortality of only 13.6 per cent.

In Deaver's[2] last 13 cases, 3 (23 per cent.) died, 1 of these was hopeless, and in 2 drainage of the biliary tract did not prevent a fatal outcome.

At operation in these acute fulminant cases we find fat necrosis, an odorless beef-broth fluid, and a greatly swollen pancreas. There are two avenues of approach to the acutely inflamed pancreas, either through an incision in the gastrohepatic omentum or through the gastrocolic omentum (Fig. 486). Multiple punctures are made and gauze or rubber tube drains inserted.

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[1] Vide supra.

[2] Vide supra.

2. **Subacute Cases.**—In these it is best to pursue the plan employed in the case we have shown you today, namely, to incise over the tender mass in the epigastrium often to the left of the median line. Unless the gastrocolic or gastrohepatic omentum is adherent to the abdominal wall, as in our case, it is necessary to wall off with gauze in order to prevent escape of the extremely toxic fluid into the general peritoneal cavity. In these subacute cases the characteristic beef-broth fluid seen in the very acute cases is absent.

Areas of fat necrosis which are present in large numbers in the acute cases are not as common in the subacute cases, but when present are pathognomonic of pancreatic inflammation. At times a counter drain may need to be inserted, the point of election being the left costovertebral angle.

This case of subacute pancreatitis shows how necessary it is to bear in mind this most interesting disease in the differential diagnosis of acute abdominal conditions.

CLINIC OF DR. ALBERT J. OCHSNER

Augustana Hospital

TRANSGASTRIC CAUTERIZATION OF CRATER ULCER ON POSTERIOR WALL OF STOMACH

Summary: Patient, sixty years of age, cachectic, giving a history of gastric ulcer of several years' duration; discovery at operation of old, indurated ulcer on posterior wall of stomach adherent to retroperitoneal structures; cauterization of ulcer by transgastric route—reasons for adopting this procedure.

The patient, a married woman aged sixty, was admitted to the hospital July 13, 1919.

Family History.—Mother died at forty-eight from what was thought to be some form of gastric disturbance. The family history is otherwise negative with reference to stomach trouble.

Past History.—Two years ago patient was treated for gastric ulcer with, apparently, much improvement.

Present Complaint.—The chief complaints are: pain in the epigastrium, just above and to the left of the umbilicus; nausea and vomiting coming on immediately after eating; marked loss of weight since onset of pain; inability to retain food. The pain is cutting in character, radiating to shoulders and sides, and is constantly present. The pain is made worse by the taking of food.

Physical examination is negative except for a definite pain point in the epigastrium just above and to the left of the umbilicus. Palpation elicits an indefinite mass in this location.

This patient was under treatment in this hospital two years ago for ulcer of the stomach. At that time operative treatment was recommended, but the patient could not muster up the necessary courage. Consequently, she was placed on an alkaline diet, under which her condition improved considerably, but she was never able to regain her former weight. Recently her suffering has been intense, the pain being located above and to the left of the umbilicus and extending into the back. One of the marked features in her case is an inclination to vomit almost immediately after she has swallowed food; the moment the food touches the stomach the latter shows a tendency to expel it. We have observed this condition especially in cases in which the ulcer is located nearly opposite the entrance of the esophagus. There can be no doubt that this condition began as an ulcer. It is, however, practically impossible to tell whether the condition is still in the form of an ulcer or whether it has degenerated into a carcinoma. The severe emaciation would in either case be due to the fact that it is practically impossible for her to retain any considerable amount of food of any kind. Our inclination would be toward a diagnosis of carcinoma and, if this diagnosis is confirmed by exploratory operation, then the operation will have been of no benefit to the patient because there is no pyloric obstruction which can be removed by operative measures, and the location of the tumor will probably preclude the possibility of its removal. In the case of inoperable carcinoma obstructing the pylorus the patient can, of course, be greatly benefited by gastro-enterostomy which will enable the patient to retain nourishment. However, an exploratory operation cannot reduce this patient's chances of recovery to any considerable degree and, therefore, we seem fully justified in making one.

We have not observed the patient for nearly two years, as she was under the care of a local physician, but the *x*-ray examination at the time she was here before clearly located the ulcer. Consequently it will not be wise to subject the patient to the wear and tear which would result from another barium meal and *x*-ray examination, especially in view of the fact that the clinical history and physical examination clearly establish the diagnosis so far as the ulcer and its location are concerned, and *x*-ray examination would not be at all reliable with an ulcer in this location for the purpose of determining the malignancy or non-malignancy of the ulcer. For the same reason we have not repeated the chemical examination of the stomach contents. Whatever the result of such examination might be, it would not add anything of benefit to our patient, and the irritation due to the introduction of the stomach-tube might do a considerable amount of harm.

Her mouth has been thoroughly disinfected and she has received 2 ounces of castor oil and no food with the exception of broth for twenty-four hours, so that the stomach and intestines are as free from infectious material as it is possible to make them with safety to the patient.

Operation.—An incision is made from the sternum to a point 3 cm. below the umbilicus in order to expose the stomach thoroughly. The gall-bladder and ducts are first examined by palpation; then the duodenum, pylorus, appendix, and pelvic organs. All these are found to be normal. The only abnormal condition consists of a broad, indurated mass, 7 cm. in diameter with a central deep depression about 2 to 3 cm. in diameter. The entire mass is located in the posterior wall of the stomach to the left of its middle and is strongly adherent to the pancreas and to the tissues above this organ. One receives the impression that the tumor mass consists of a gastric ulcer on the posterior wall of the stomach which has perforated into the pancreas and has caused adhesion of the middle three-fifths of the stomach to the posterior abdominal wall. It is still impossible to tell definitely whether this ulcer has undergone malignant degeneration or not, but one obtains the impression that one has to deal with a malignant condition. Under these conditions it is quite clear that it would be entirely impossible to remove this growth because of the involvement of so large a portion of the posterior wall of the stomach, because of the extensive infiltration of the underlying tissues, and particularly because of the involvement of the underlying pancreas. It seems, however, worth while to lay open the stomach and examine the mass by direct inspection.

We will consequently make an incision through the anterior wall of the stomach for a distance of 7 cm. (Fig. 488, 1). This portion of the stomach is its least vascular part, consequently we need not anticipate much hemorrhage. In order to keep the

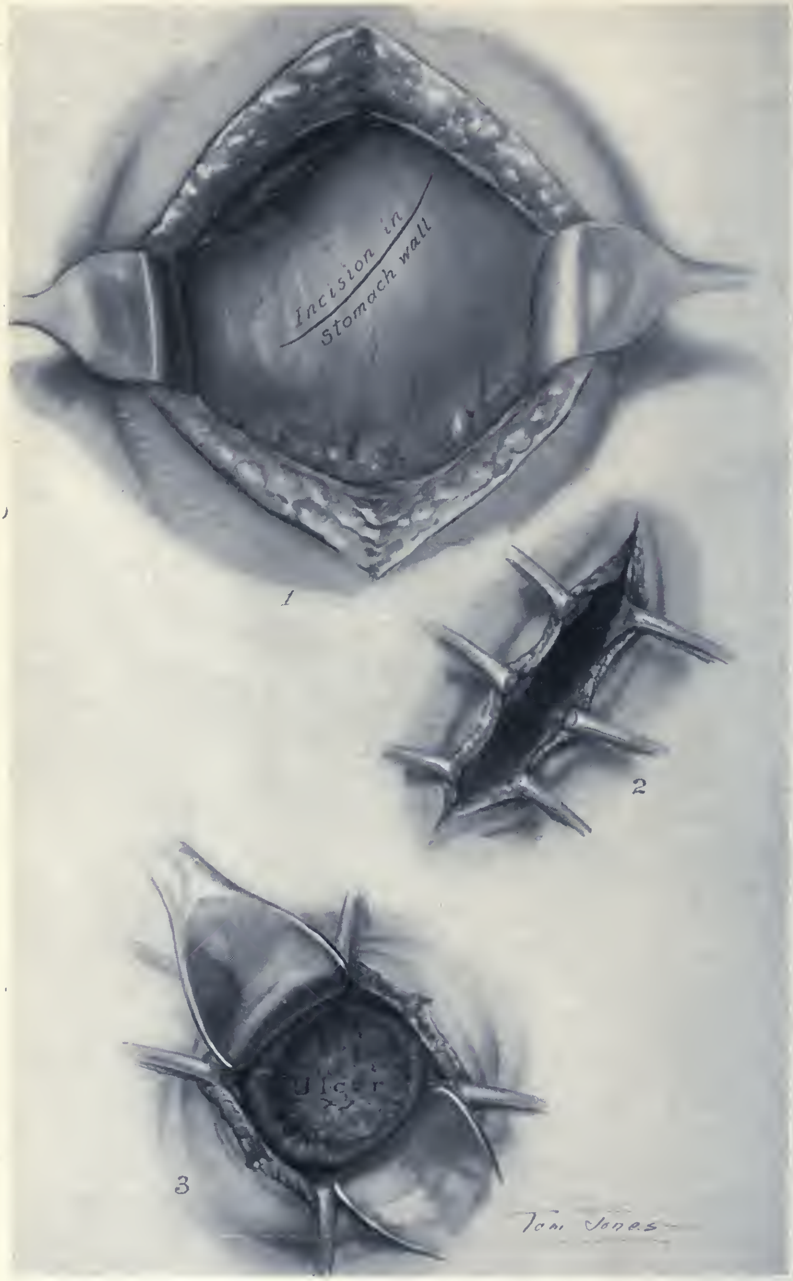

Fig. 488.—Exposure of ulcer in posterior wall of stomach through an anterior incision.

edges of this incision as little traumatized as possible we place mouse-tooth forceps of the Allis pattern upon the edge of the wound about 2 cm. apart, grasping all the layers of the stomach wall so that the mucous membrane may not be separated from the muscularis during our manipulations (Fig. 488, 2). Then we place broad Jackson vaginal specula into the stomach through this wound and in this way expose the ulcer perfectly (Fig. 488, 3), illuminating the field by placing a strong electric light directly over the incision. Even at the present time, with the ulcer fully in view, it is impossible to determine positively whether the condition is simply an indurated ulcer or whether carcinomatous infection has taken place upon its surface.

The only treatment which promises benefit to the patient is cauterization of the ulcerated area with the electric or actual cautery. Because of the extreme vascularity of the tissues it seems best to destroy the edge by means of the bright heat of the cautery. The entire ulcerated surface is being cauterized until every portion is covered with an eschar to the distance of about 1 cm. from the original edge of the ulcer (Fig. 489, 4). The dull heat has prevented the occurrence of hemorrhage. The little mucus that has been secreted by the surrounding mucosa has been sponged away constantly, so that we now have a perfectly clean crater in place of the original ulcer (Fig. 489, 5). It seems as though the amount of destruction of tissue with the cautery may have killed any cancerous invasion that may have taken place upon the surface of this ulcer, and consequently this form of treatment seems to give the patient the best chance of recovery even in the case of extensive cancerous degeneration of the ulcer. It would, of course, have been interesting to remove a portion of the edge of this ulcer for microscopic examination, because in that manner we could have been positive about the diagnosis, but, with the patient in her very low physical condition, this would have added additional risk, which does not seem warranted. Moreover, unless we had removed a portion of every part of the ulcerated surface, negative findings would have been of no value, because in these ulcers we frequently find one portion infected by cancer while other portions are still free. There

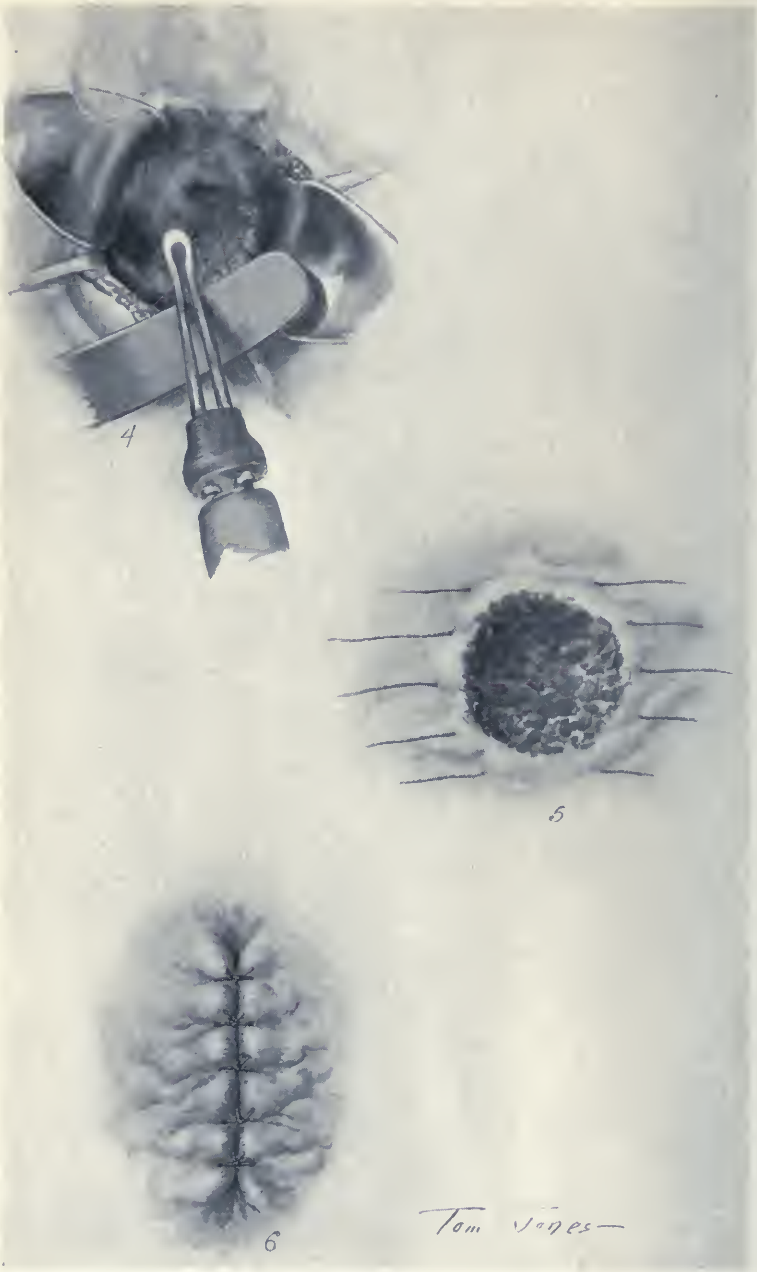

Fig. 489.—Cauterization of ulcer and closure of defect by sutures.

is a considerable amount of danger from hemorrhage in these cases at the time the eschar is loosening, and in order to guard against this in a measure I will place a number of interrupted sutures of chromicized catgut for the purpose of bringing the edges of this eschar together. I will use No. 3 catgut of the variety that will hold in ordinary tissues about thirty days. In the presence of the gastric juices it will, of course, not hold for so long a period. It seems unwise to use silk in this location for fear of future irritation, and consequently we will depend upon this chromicized catgut (Fig. 489, 5, 6).

The incision into the stomach is now carefully closed with two rows of sutures and the abdominal wound is closed in the usual manner. The entire operation has consumed about forty minutes, so that the patient is in nearly as good condition as when the operation was begun, because great care has been taken not to traumatize the intra-abdominal organs.

The patient will be supported by the use of nourishing enemas. From the third day on gruels will be given by mouth every two hours, with the addition of from ½ to 1 teaspoonful of milk of magnesia, or in case this acts too freely upon the bowels ½ ounce of lime-water will be substituted for each dram of the milk of magnesia. In case of vomiting gastric lavage with the water at 105° F. will be given. The head of the bed will be elevated in order to prevent congestion of the lungs. In case of great thirst normal salt solution will be injected subcutaneously to the amount of 1000 to 1500 c.c. from two to three times a day if necessary.

Note.—October 6, 1919: Twelve weeks after operation the patient is out of bed and able to take non-irritating food. Her color and general appearance are good. She has not as yet begun to gain in weight, probably due to the fact that, although nourishment is given every three hours, the quantity is too small to more than supply the amount needed for maintaining her present condition.

CLINIC OF DR. ALFRED A. STRAUSS

Michael Reese Hospital

SURGICAL TREATMENT OF GASTRIC ULCER WITH NEW METHOD OF PYLOROPLASTY

Summary: Reasons for failure of simple gastro-enterostomy in treatment of gastric ulcer; arguments against partial gastrectomy; local excision of ulcers—why desirable; pyloroplasty to prevent pylorospasm and ensure adequate drainage of stomach; technic of combined excision and pyloroplasty.

This morning we have for operation one patient with gastric ulcer of the lesser curvature and another with duodenal ulcer.

The types of operation for ulcer of the lesser curvature have varied from extreme partial gastrectomy to simple gastro-enterostomy. I have been very much impressed by the statements made by medical men who have had the after-care of these patients. They state that those who have their ulcers excised respond better, have fewer symptoms while recovering from the operation, and are practically cured; those who have a simple gastro-enterostomy have a more protracted course of symptoms after operation, and many of them show very little improvement. When this operation was first employed surgeons performed it because they believed that it would produce drainage from the stomach to such an extent that all the food would go through this opening and none through the normal pyloric opening. Since then many advances have been made in our knowledge of the physiology of the stomach and also in the pathology of ulcer through fluoroscopic and Roentgen-ray examinations. In all these studies it has been proved that a stomach with a gastro-enterostomy functionates in an entirely different manner from that intended by the original operation, namely, that instead of the food passing through the gastro-enterostomy opening, less than 50 per cent. passes through it, while the greater amount still passes through the normal pyloric opening. Simple gastro-enterostomy for gastric ulcer is of very little value because practically all the food that passed along the lesser curvature before operation still passes along the lesser curvature after operation.

The advocates of simple gastro-enterostomy for lesser curvature ulcer claim that there is regurgitation of bile through the gastro-enterostomy opening into the stomach which has a curative value in healing the ulcer by reducing the acidity of the stomach. When we consider the physiology of digestion in its relationship to the flow of bile this theory of regurgitation and reduction of acidity becomes very doubtful. The bile and pancreatic secretion mixes with the 50 per cent. or more of food which comes through the pylorus. This passes on into the jejunum and not through the gastro-enterostomy opening. Practically no bile can regurgitate into the stomach during the process of digestion, and the only time bile may regurgitate into the gastro-enterostomy opening is at night when the patient is at rest and his stomach is empty. We know that when the stomach is empty the bile flows back into the gall-bladder instead of flowing into the duodenum, and the gall-bladder only discharges its bile into the common duct when there is a reflex stimulus produced by food passing through the duodenum. More than that, if enough bile would pass on through the gastro-enterostomy opening to produce a curative effect, such an amount of bile would nauseate the patient and give symptoms of a vicious circle. I would also add that the fractional test-meals in simple gastro-enterostomized patients have shown very little change in their acidity, and very few of them reveal the presence of bile in the aspirated contents four to six weeks after operation.

Considering the relationship of ulcer to cancer, I know from clinical and pathologic experience that many ulcers which appear benign at the time of operation are found, upon microscopic examination, to have undergone malignant changes. There can be very little argument in favor of doing a gastro-enterostomy on a patient with such an ulcer.

The only reason that ulcers on the lesser curvature are not excised more frequently is that they are difficult to excise, and when it is attempted excision produces so much mutilation that it is necessary to remove the entire pyloric segment. A number of men here and abroad, especially Rodman and Deaver, have carried out the principle of always excising the ulcer by doing a partial gastrectomy and then performing gastro-enterostomy. The principle of excising the ulcer is correct, but to excise the ulcer and with it take the most important part of the stomach, as they do in partial gastrectomy, is wrong.

Thalhimer and Wilensky, also McCarty, of the Mayo Clinic, have shown that in ulcers of the lesser curvature undergoing malignant change the cancer does not extend beyond the point of induration, and Wilensky especially has shown by serial section that when you cut from 1 to 2 cm. beyond the indurated area of the ulcer the muscularis and mucosa of the stomach are perfectly normal. I, therefore, want to emphasize the fact that whether an ulcer is malignant or benign, if you excise it for a centimeter or two beyond the indurated area, you have done as radical a removal for practical purposes as if you had removed half the stomach.

The ideal object of any surgical procedure should be to do away with the pathologic condition and leave the organ in as nearly normal anatomic condition and physiologic relationship as possible. In doing partial gastrectomy for lesser curvature ulcer some men leave only the body of the stomach, whose function we know to be entirely different from that of the pylorus. The fact that the patient lives in spite of this does not prove the operation to be justifiable. We know that the body and fundus of the stomach during the process of digestion are in a state of tonic contraction, throwing the food out in small portions into the pyloric antrum or vestibule. If that portion is cut off, as it is in partial gastrectomy, the tonic contractions of the body and fundus on the gastro-enterostomy placed in that locality causes the stomach to empty within twenty to thirty minutes. This certainly must be an abnormal condition, for it is the function of the stomach to retain food from three to eight hours, where it undergoes certain forms of digestion, passing into the intestine in small bits and not jamming through the gastro-enterostomy opening in twenty to thirty minutes.

Mayo, Küttner, Hartmann, and Payr have practised excision of ulcers of the lesser curvature and found that the stomach did not empty itself properly owing to pylorospasm, which was noted in a large number of patients; for this reason, in several instances, they have either had to perform gastro-enterostomy at a second operation or to remove, in the first operation, the entire segment of the stomach in which the ulcer occurred.

I am sure that gastro-enterostomy is entirely unnecessary to prevent pylorospasm or to give the stomach a quicker emptying time. This can be accomplished by a simple pyloroplasty in which I remove a small portion of the sphincter muscle of the pyloric ring. This relieves the spastic condition of the pylorus, does away with the sphincter control of the pylorus, and allows the stomach to empty in about half its normal time. I have practised this in the last five years, and have had no occasion in any of these cases to resort to gastro-enterostomy for the purpose of relieving pylorospasm after doing pyloroplasty in conjunction with excision of ulcers on the lesser curvature.

It will be noted from the experience of all these surgeons that excision of the ulcer would be the most logical procedure if it did not require too much additional surgery and mutilation of the stomach. This is especially true when we consider the problem of the relationship of ulcer to cancer and the work of Rosenow, who has demonstrated that ulcers of the stomach are lesions produced by streptococcic infection similar to lesions in an inflamed gall-bladder and inflamed appendix. If this is true, then there can be no valid reason why an ulcer of the stomach should not be treated the same as a chronically inflamed gall-bladder or inflamed appendix, namely, by excision.

One more point which I want to call to your attention is that in 16 cases of gastric ulcer which had marked hyperacidity ranging from 100 to 160 free HCl before operation and in which the ulcers were excised and pyloroplasty performed, the fractional test-meal after operation revealed the secretion to have come to a normal or subnormal acidity within three to five weeks. This speaks volumes for the fact that hyperacidity and hypersecretion are the results of ulcer rather than the cause or etiologic factor in its production. This also supports Rosenow's theory of infection.

I, therefore, want to repeat for the sake of emphasis the reasons why I believe that all gastric ulcers should be treated by a simple method of excision in conjunction with pyloroplasty instead of gastro-enterostomy.

1. It is absolutely impossible in many instances to tell at the time of operation whether the ulcer is benign or malignant.

2. In excised ulcers it is possible to demonstrate organisms just as in an infected gall-bladder or appendix; therefore, the same surgical principle that holds good for the latter should hold good for the former.

3. In a series of 16 patients who had marked hyperacidity before operation, all had normal or subnormal acidity after ulcer excision. This demonstrates that the ulcers cause the abnormal secretions rather than that the abnormal secretions caused the ulcer. It also supports Rosenow's theory that ulcer is a localized infection, and abnormalities in the secretion are the results of it.

4. By excising the ulcer and only removing the pathologic tissue we rid the patient of his lesion and leave the organ intact to carry on its important normal physiologic function.

5. I will demonstrate to you in a moment that by performing simple pyloroplasty in conjunction with ulcer excision, instead of gastro-enterostomy, we give the stomach a quick emptying time (one-half the normal). This prevents hyperacidity and continued hypersecretion and leaves the stomach and duodenum in their normal anatomic and physiologic relationships.

6. The combined operation of ulcer excision and pyloroplasty takes less time than gastro-enterostomy or any other type of operation, takes less surgical skill, and produces less shock to the patient.

The clinical course in a large number of cases that I have operated by this method has been most satisfactory. The patients are placed in Fowler's position as soon as they are out

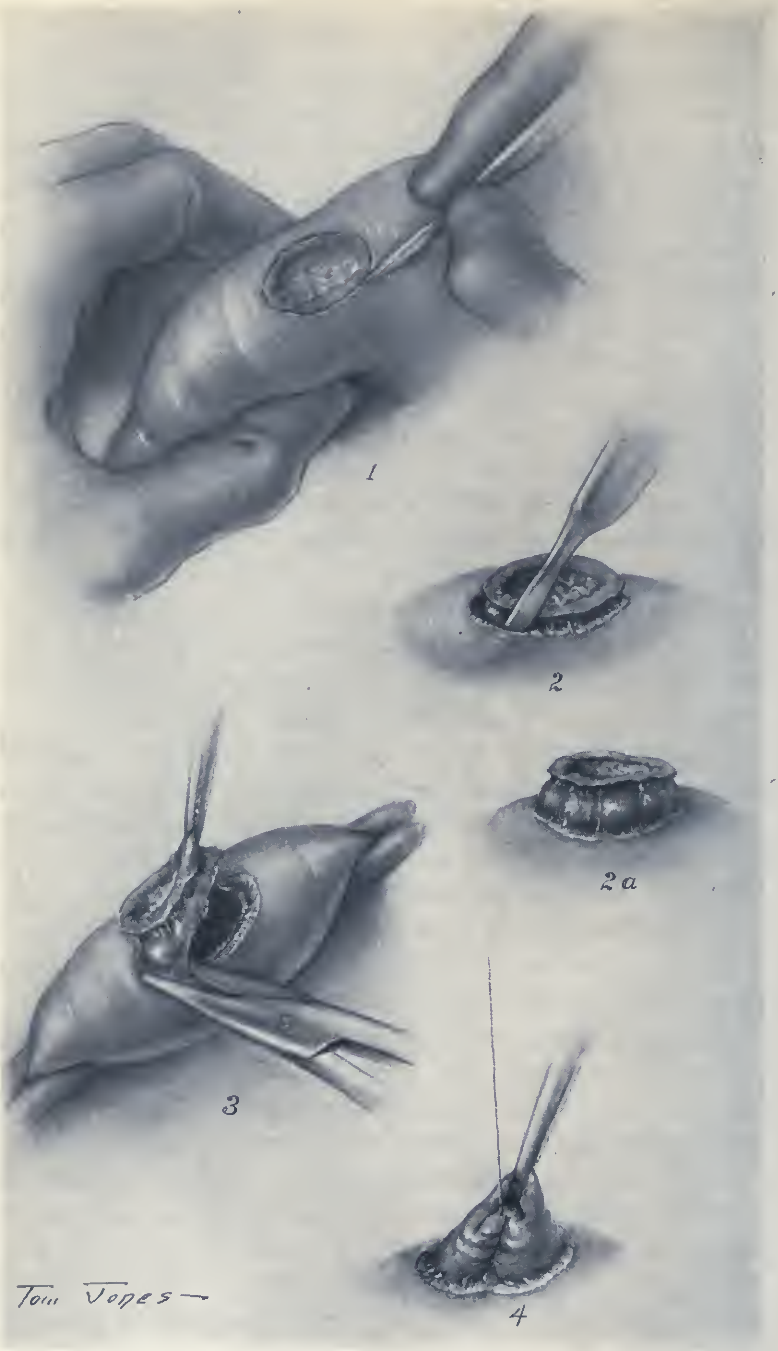

Fig. 490.

of the anesthetic. They have no gas-pains, and none of them seem to vomit or have gastric distress. They are not allowed anything by mouth for forty-eight hours; instead, they receive 1 quart of Ringer's solution intravenously and 1 quart of 5 per cent. glucose per rectum in twenty-four hours for two days. I do not allow water by mouth for forty-eight hours because, first, withholding water keeps the stomach dry and prevents nausea and vomiting, and second, experimental work on dogs demonstrates that early administration of water interferes with healing by reason of the fact that the stitch-holes and sutured area become water soaked, although leaking does not occur. At the end of forty-eight hours the patients are allowed milk and cream in 1- and 2-ounce doses; the fifth day, a light soft diet; the eighth day, soft diet; and at the end of the second week, a full diet.

I do not give sodium bicarbonate or calcined magnesia. The patient needs no medical care or special diet because he has now a normally functioning stomach. The only symptom that these patients complain of is marked hunger, which is probably due to the rapid emptying of the stomach.

It is interesting that all these patients that we followed up have gained very rapidly in weight and are able to eat all kinds of food.

Fluoroscopic examination four years after operation showed that they all have an emptying time from one and one-half to three hours. I believe this is an important factor and explains why these patients are free from gastric symptoms without medical aid or alkalies.

I shall demonstrate to you this morning the type of operation which I perform on these cases.

The patient, a man forty years of age, gives a history of hav-

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Fig. 490.—1, Elliptic incision around indurated ulcer area extending through muscularis down to mucosa; 2 and 2*a*, with several strokes of the scalpel the mucosa about the ulcer is freed from the muscularis and balloons up into the incision, carrying the ulcer with it. The ulcer is excised (3) and the mucosa inverted (4) by means of a Connell stitch which is inserted transversely to the longitudinal axis of the stomach.

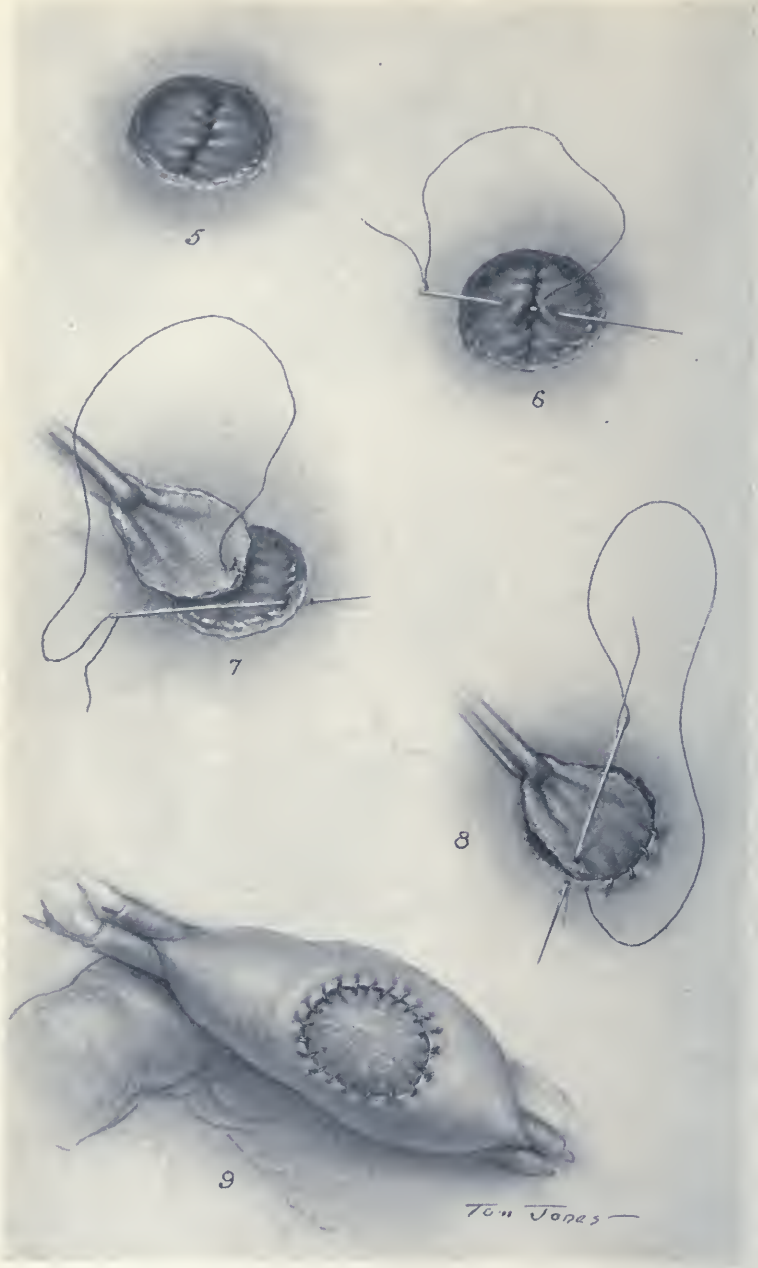


Fig. 491.

ing undergone medical treatment on three different occasions by a competent medical man. He was relieved only a short time after each course of treatment, the symptoms recurring with the same intensity shortly afterward. *x*-Ray examination reveals a typical pyramid on the lesser curvature about 2 inches from the pyloric ring.

I shall now make a midline incision reaching from the ensiform cartilage to the umbilicus. On opening the abdomen I find the gall-bladder and duodenum perfectly free. The gall-bladder appears pearl blue, easily compressible, and no stones are found in it. On placing my finger in the foramen of Winslow I am able to palpate the common duct and pancreas, and find it to be perfectly normal. Here we have the pyloric ring—notice the vein which indicates the first part of the duodenum. The pylorus easily admits the index-finger and is perfectly free from thickening or infiltration. On examining the lesser curvature we find a markedly indurated area, and by holding this area between the thumb and index-finger I find a typical nest-shaped ulcer. This is hard and indurated, and its edges are infiltrated. Beyond the indurated edge the stomach is perfectly normal. A ligature is now placed upon the gastric arteries of the lesser curvature well beyond each end of the indurated area. I now make an elliptic incision around the indurated area of the ulcer through the muscularis down to the mucosa (Fig. 490, 1). A scalpel is now placed between the mucosa and muscularis, and several strokes around this area (Fig. 490, 2) frees the mucosa from the muscularis so it balloons up like a pouch (Fig. 490, 2*a*). The indurated area is now free, and one can see the normal mucosa which has been freed with the scalpel beyond the indurated area (Fig. 490, 2*a*). A stomach clamp is now applied, and the ulcer is cut away with fine scissors (Fig. 490, 3). The mucosa

Fig. 491.—5, The Connell suture completed; 6, a Lembert suture covering the Connell suture; 7, the edge of the fascial transplant is caught by a single suture and then the needle is passed between the mucosa and muscularis so as to pull the transplant in and have it imbricated between the mucosa and muscularis; 8 and 9, the imbrication is completed by a simple over-and-over suture.

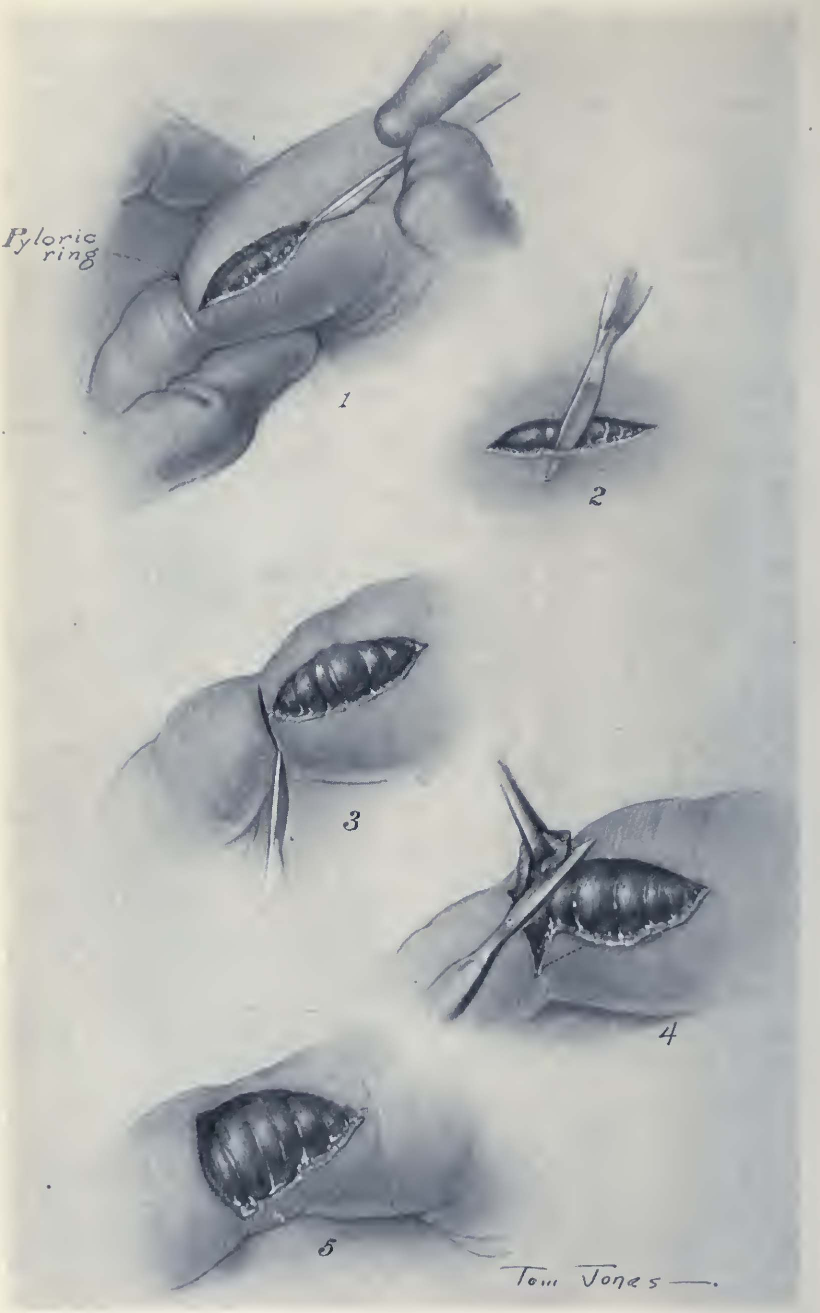


Fig. 492.

is carefully examined, and any portion which looks pathologic is trimmed away. The mucosa is now closed separately with a Connell suture (Figs. 490, 4; 491, 5) and reinforced by a Lembert suture (Fig. 491, 6). If the ulcer were of small size the musculature could now be closed by simple suturing or by a Lembert suture and the omentum brought over this area, but as the ulcer is of large size it would be very difficult to bring the muscularis together without producing marked deformity of the lesser curvature. For this reason I now take an oval-shaped piece of fascia lata from the thigh, which is imbricated between the mucosa and muscularis (Fig. 491, 7). This is accomplished by a simple over-and-over suture of black waxed silk (Fig. 491, 8, 9).

Now that the ulcer is excised, the next step is to see that the stomach empties quickly. Most men now do a second major operation, gastro-enterostomy, which I believe is entirely unnecessary. The procedure which I follow is that of simple pyloroplasty, which takes away the sphincter muscle of the pyloric ring. This simple operation, which takes less than five minutes, gives the stomach an emptying time of half the normal, does away with pylorospasm, and allows gastric peristalsis to flush the food through the paralyzed ring. In about six weeks some of the sphincter action is regained.

The pyloric portion of stomach is now grasped between thumb and index-finger. An incision is made, 1 inch in length, from the pyloric ring back upon the pyloric antrum. This first incision goes through the muscularis down to the mucosa (Fig. 492, 1). A scalpel is now placed between the mucosa and muscularis in order to free the mucosa from the muscularis (Fig. 492, 2). A second incision is made at right angles to the first, going through the pyloric ring down to the mucosa (Fig. 492, 3). A small

Fig. 492.—1, The pyloric portion of stomach is grasped between thumb and index-finger. An incision 1 inch in length is then made through the muscularis down to the mucosa, extending from the pyloric ring on to the pyloric antrum; 2, the scalpel is passed between the mucosa and muscularis so as to free the mucosa from the muscularis; 3, a second incision is made at right angles to the first, going through the pyloric ring down to the mucosa; 4, a small triangular portion of the free edge of the pyloric ring muscle is cut away; 5, the ring muscle cut away, leaving the bulging mucosa.

triangular portion (Fig. 492, 4) of the free edge of the pyloric ring muscle is now cut away, leaving a triangular window of mucosa (Fig. 492, 5), and the entire area, both ulcer (Fig. 493, *A*) and pyloroplasty (Fig. 493, *B*), is covered by the free edge of the omentum.

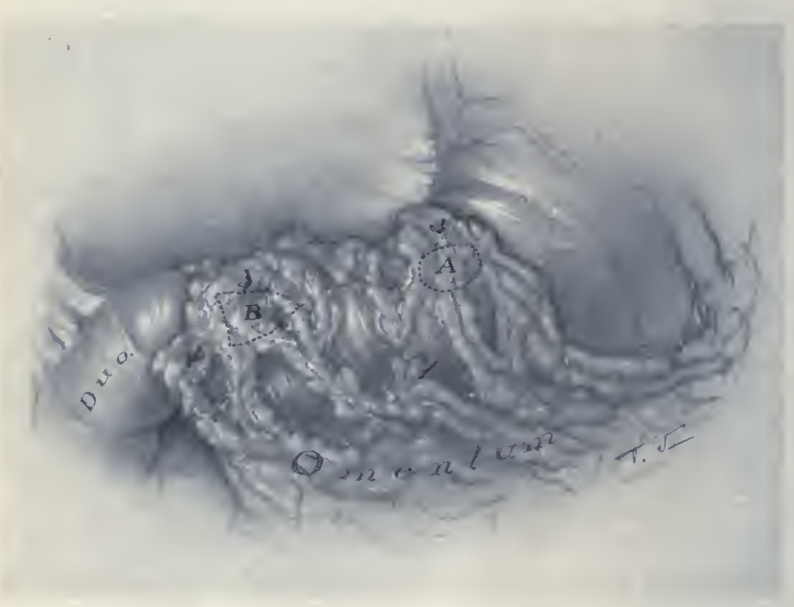


Fig. 493.—*A*, Ulcer on lesser curvature; *B*, pyloroplasty covered by free edge of omentum.

I consider the bringing over of the free edge of the omentum one of the most important and vital portions of the operation. I showed six years ago in my experimental work on dogs that the omentum not only prevents leakage and hemorrhage, but establishes a new blood-supply and collateral circulation to the transplant and that portion of the stomach.

EXCISION OF DUODENAL ULCER: PYLOROPLASTY

Summary: Surgical treatment of duodenal ulcers; value of pyloric occlusion; technic of operation for permanent occlusion by submucous fascial transplant; technic of excision of duodenal ulcer and repair of defect.

THE second patient for operation this morning is a man twenty-six years of age, who is suffering from a bleeding duodenal ulcer. He has been under medical treatment on two different occasions. The first treatment was three years ago. At that time he was confined to the hospital for six weeks on starvation treatment and all the careful routine that goes with the medical management of duodenal ulcer. One evening, six months after the first treatment, he suddenly became faint and very pale and an hour afterward vomited blood. It was very evident from the history and from the record of the medical attendant that he was suffering a severe, acute hemorrhage from his duodenal ulcer. He was given careful medical treatment and made a good recovery.

A few days ago he entered the hospital on account of extreme paleness and severe cramp-like pains in his abdomen. He states that his stools were black during the last week and that he felt nauseated at various times. His hemoglobin is now down to 25, and fluoroscopic examination reveals a typical defective cap just beyond the pyloric ring in the first portion of the duodenum. There is no questioning that this man is having a slow hemorrhage from his duodenal ulcer.

In 1912 I did some experimental work on animals with the object of devising some operation for duodenal ulcer. I demonstrated that by closing off the pylorus by a submucous fascial transplant taken from the fascia lata of the thigh we could produce permanent pyloric closure. The procedure, which is described in the Journal of the American Medical Association, October 31, 1914, is briefly as follows:

An incision 1 inch in length is made from the pyloric ring back upon the pyloric antrum through the muscularis down to the mucosa. Two strokes with the scalpel on each side between the mucosa and muscularis free the mucosa sufficiently so that the thumb can be placed under the pylorus, grasping the edge of the muscularis. The entire muscularis can be everted so that the mucosa lies on the everted muscularis like a rubber tube. It can now be easily separated with a sharp scalpel from the muscularis. A free fascial transplant from the fascia lata is now sutured around the mucosa, forming a tight cuff. The mucosa is dropped back, and the muscularis is closed.

I have practised this procedure combined with gastro-enterostomy in every case of duodenal ulcer operated in the last six years with splendid results. Patients operated on by this method are free from pain and the usual symptoms of hyperacidity. Practically all are placed on a full diet within two to three weeks after operation without any medication or alkalies.

There is certainly a great difference between the clinical course of patients following pyloric closure as compared with patients who have a simple gastro-enterostomy. This can be easily explained by the fact that this simple closure, which only takes about ten minutes, has the following effect: It prevents food and hydrochloric acid passing over the ulcer, and all peristaltic waves in the duodenum are interrupted from the point of closure around to the gastro-enterostomy opening. Now these three important results that the closure accomplishes are exactly what the medical man tries to do in the medical treatment of ulcer, but he can only carry out these important steps relatively and for a short time. For instance, by starving his patient he prevents food from passing through the pylorus; by giving alkalies in large quantities he prevents hydrochloric acid passing over the ulcer; and by giving atropin he relieves the pylorospasm and hyperperistalsis. This can only be carried out for a certain length of time, while this permanent closure accomplishes these three important points for all time.

In the last two years I have been so impressed with the good results of excision of gastric ulcers that I have tried in every way possible to apply a similar technic for duodenal ulcers wherever it is possible to accomplish it. I believe that all duodenal ulcers that are in the first portion and anterior wall of the duodenum can be excised and a plastic performed on the pylorus without gastro-enterostomy. This procedure gives better results than closure and gastro-enterostomy, but I do not believe it wise to try and excise ulcers in the second portion of the duodenum or those located on the posterior wall. When they are in these localities I prefer to do a permanent pyloric closure by a fascial transplant and gastro-enterostomy. In bleeding ulcer, like we have here this morning, I perform an operation the technic of which I will demonstrate to you. Although I have performed this operation only four times it has been very successful in each attempt.

Before performing the operation this morning I will transfuse the patient with 1 quart of blood by the Percy paraffin tube method. I like this method of transfusion where I have two adults with large veins, and believe it to be very practical. I believe that all patients who are emaciated from dieting and inanition and have a fairly low hemoglobin should be transfused before operation. I think it does the patient much more good to be transfused before operation and prevent shock than to try and transfuse him after operation in the hope of relieving shock.

I now make a midline incision from the ensiform cartilage to the umbilicus. When I open the abdomen the stomach and bowel appear very pale. The stomach and pylorus are perfectly free. Just beyond the pyloric ring on the anterior wall of the duodenum we find a markedly indurated ulcer about the size of a quarter. I will now excise this ulcer and do a plastic on the pylorus by making a tongue-shaped flap which is pulled over into the defect made by excision of the ulcer.

Grasping the pylorus between the thumb and index-finger, I make an incision through the muscularis down to the mucosa around the ulcer, carry it through the pyloric ring, and then in the shape of a tongue into the pyloric antrum (Fig. 494, 1). A scalpel is now placed between the mucosa and muscularis, and several strokes along the line of this incision free the mucosa

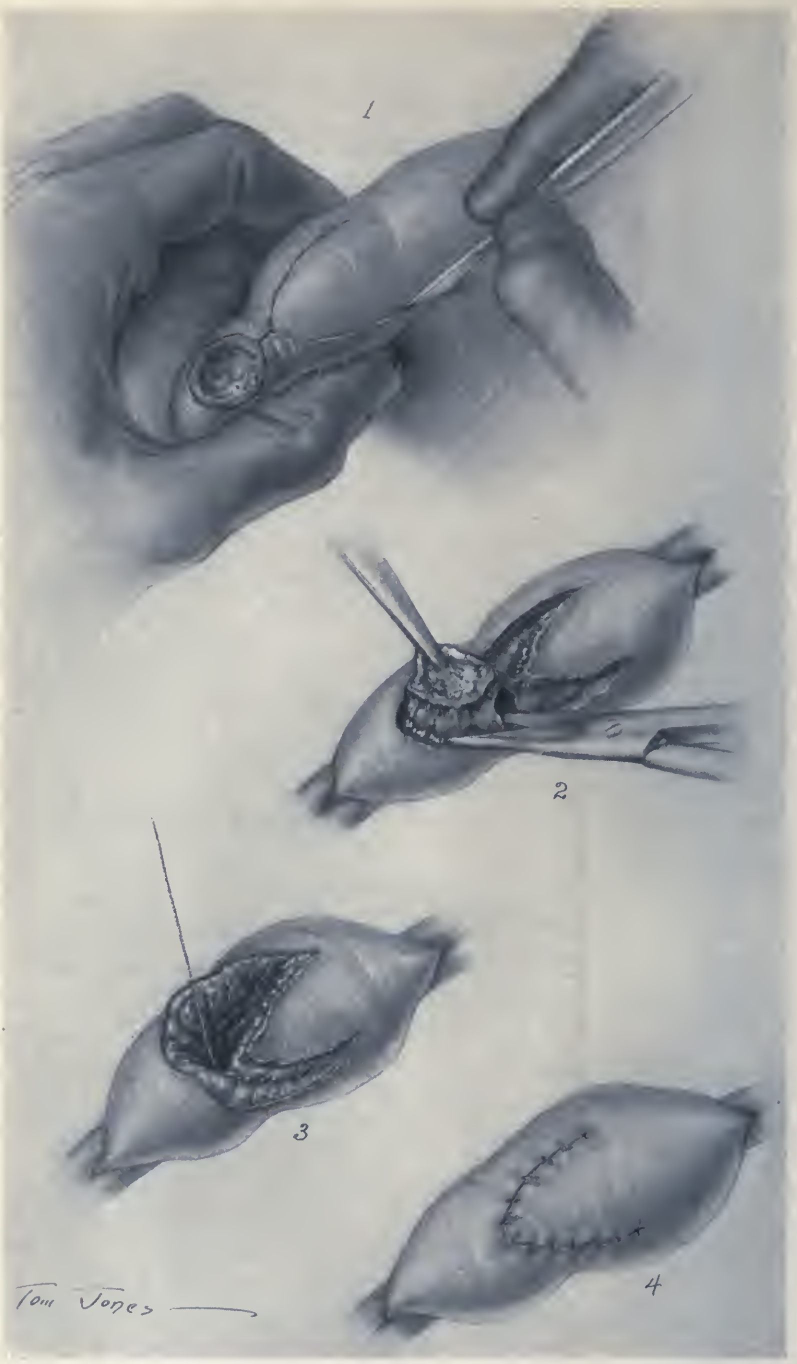


Fig. 494.

from the muscularis so as to allow the mucosa to balloon out (Fig. 494, 2). By means of fine-pointed scissors I now cut away the ulcer (Fig. 494, 2). On cutting away the ulcer we notice that the duodenum is full of dark clots of blood. The mucosa of the tongue-shaped flap of the pylorus is now brought forward into the defect and sutured separately with a Connell stitch (Fig. 494, 4). The muscularis is now sutured separately with continuous over-and-over sutures. The free edge of the attached omentum is brought over the operated area (Fig. 494, 4). You will notice that the pyloric ring has been destroyed on its anterior portion, but it is wider and more roomy than before, and we are rid of the bleeding ulcer.

The four patients that I have operated on by this method are absolutely free from symptoms, and fluoroscopic examination reveals that the stomach empties in from one and one-half to two hours. I believe this is due to the fact that the pyloric ring has been destroyed to such an extent that the sphincter action of the pylorus has been lost to a great degree, and all signs of pylorospasm, of course, are absent.

You will also note that it only took us about twenty to twenty-five minutes to perform this operation. I am convinced it is very simple and very efficient.

Fig. 494.—1, The pyloric portion of the stomach is grasped between thumb and index-finger. A circular incision is made around the ulcer through the muscularis down to the mucosa. This is carried through the pyloric ring in the shape of a tongue on to the pyloric antrum; 2, the mucosa is undermined and freed from the muscularis and the duodenal ulcer excised; 3, the margin of the tongue-shaped flap of the pylorus is brought forward into the defect produced by excision of the ulcer and the mucosa is sutured separately with a Connell stitch; 4, the muscularis is now sutured separately with a continuous over-and-over suture. *Note:* The suture line is later covered by the free edge of the attached omentum, which is not illustrated in the drawing.

CLINIC OF DR. CARL BECK

North Chicago Hospital

OLD SINUS FROM HIP DISEASE TREATED BY SKIN SLIDING

Summary: Persistent sinus following resection of head of femur for tuberculosis eighteen years ago; cure accomplished by epidermization of tract; technic of operation.

Miss Y., thirty-two years old, was operated on when she was fourteen years old for tubercular coxitis. The operation was, as far as the removal of the tuberculous process was concerned, an excellent success, having been done by one of the best surgeons in those days, Nicholas Senn. The head of the femur was removed and the acetabulum cleaned out; the stump of the upper portion of the femur has, in the course of years, gradually adapted itself and formed a new head, but with restricted motion. The unfortunate thing about the case is that during all these long years she has never been rid of a postoperative fistula, which has kept on secreting a seropurulent discharge and has had no tendency to heal permanently. At times it would apparently heal under the influence of bismuth injections and remain closed for a time, only to break open again, with the usual symptoms of retention, consisting of fever, slight chill, and general ill feeling, until the abscess broke. Her physician in the East sends her to us to see if we may not be more successful with the bismuth treatment than he has been or to try some other newer method.

The general examination of this young lady shows that she is very healthy in every other respect. The right leg is very much shorter than the left, probably 2½ to 3 inches, the motion in the hip is very much restricted, only excursion to a very slight degree is possible, and she does not walk except with a crutch.

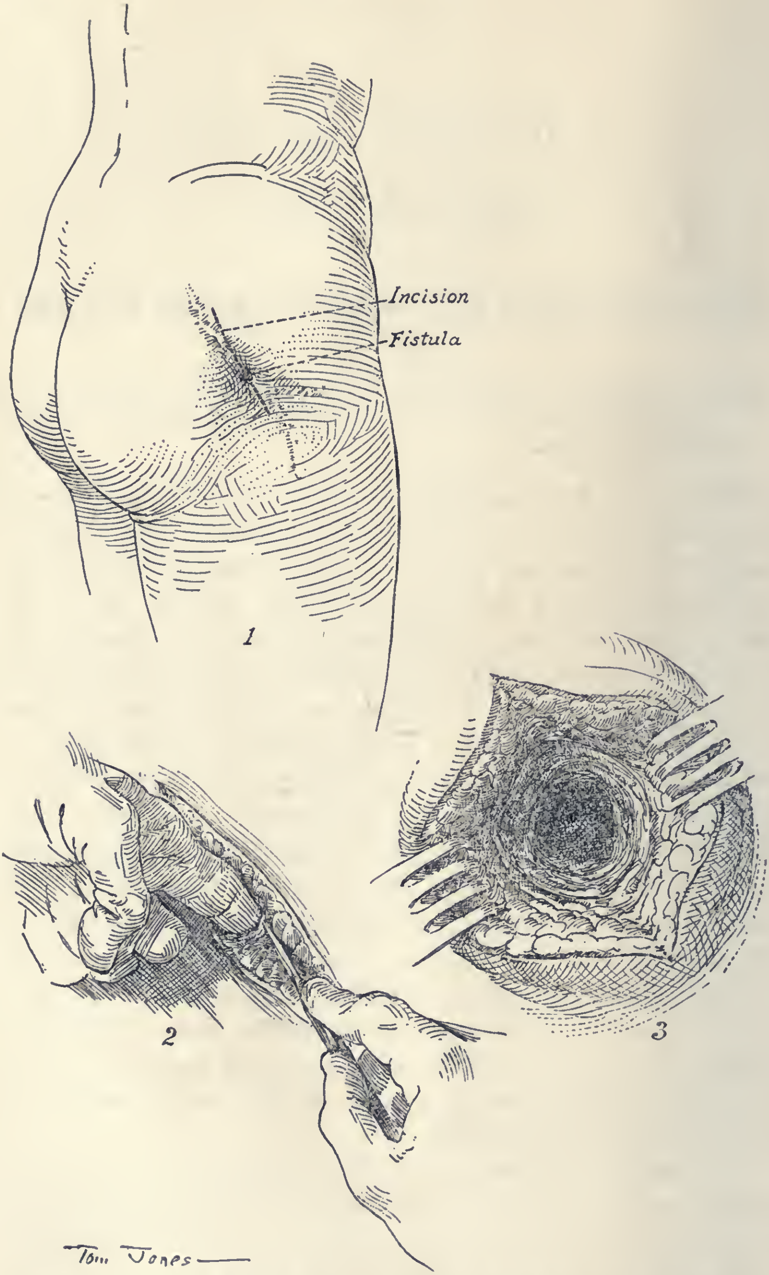


Fig. 495.—1, Orifice of sinus; dotted line indicates line of incision; 2, incision being made with the finger as a guide; 3, funnel-shaped crater ready for skin-flap.

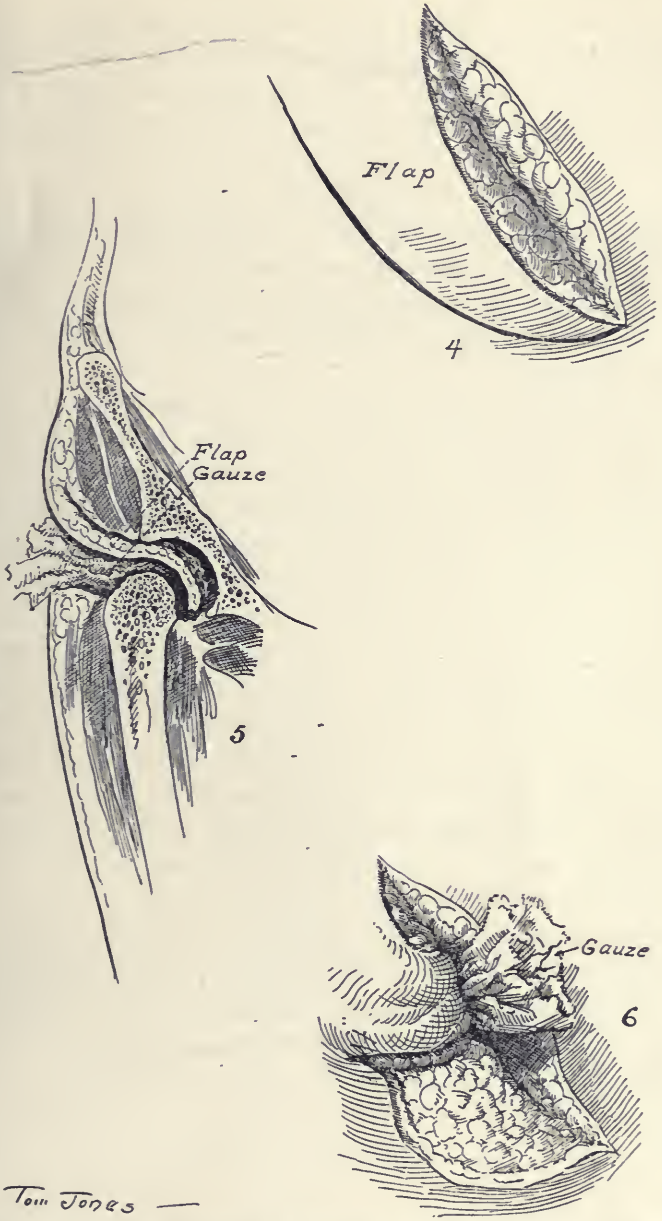


Fig. 496.—4, Skin-flap outlined; 5, 6, skin-flap in place, secured by gauze pack.

On the outer aspect of the hip, in the center of a scar, is a small fistula from which a seropurulent discharge of moderate quantity oozes in twenty-four hours. Another small fistula is at a slight distance from the first one, but at this time no discharge comes from it.

An *x*-ray picture shows that the fistula leads to a cavity of small size on the inner surface of a somewhat irregular femur. Since so many attempts have been made with the bismuth paste, and always a fistula returned, I think it is advisable to transform the cavity into one lined with skin through the method of a sliding skin-flap.

We introduce a sound into the fistula and cut in the direction of the old scar, wide enough to allow the introduction of our finger, which allows us to examine the condition on the inside; the wound is then enlarged with the knife under the direction of the finger, cutting away from the finger toward the femur (Fig. 495, 2). Retractors are inserted to open the cavity and we inspect it, so as to see whether any tubercular conditions are present. Only granulations of a harmless nature, evidently non-tubercular, fill the cavity. They are scraped away and the cavity transformed into an open funnel-shaped crater (Fig. 495, 3). A tongue-shaped flap is then cut on the outside with a broad pedicle (Fig. 496, 4), and this skin is introduced with its tip into the depth, held there by pressing some gauze into No cavity (Fig. 496, 5, 6), and an ordinary bandage applied. the suture of any kind is inserted and the whole crater is allowed to heal by secondary union and cicatrization, making frequent use of adhesive plaster dressing, which rapidly allows epidermization.

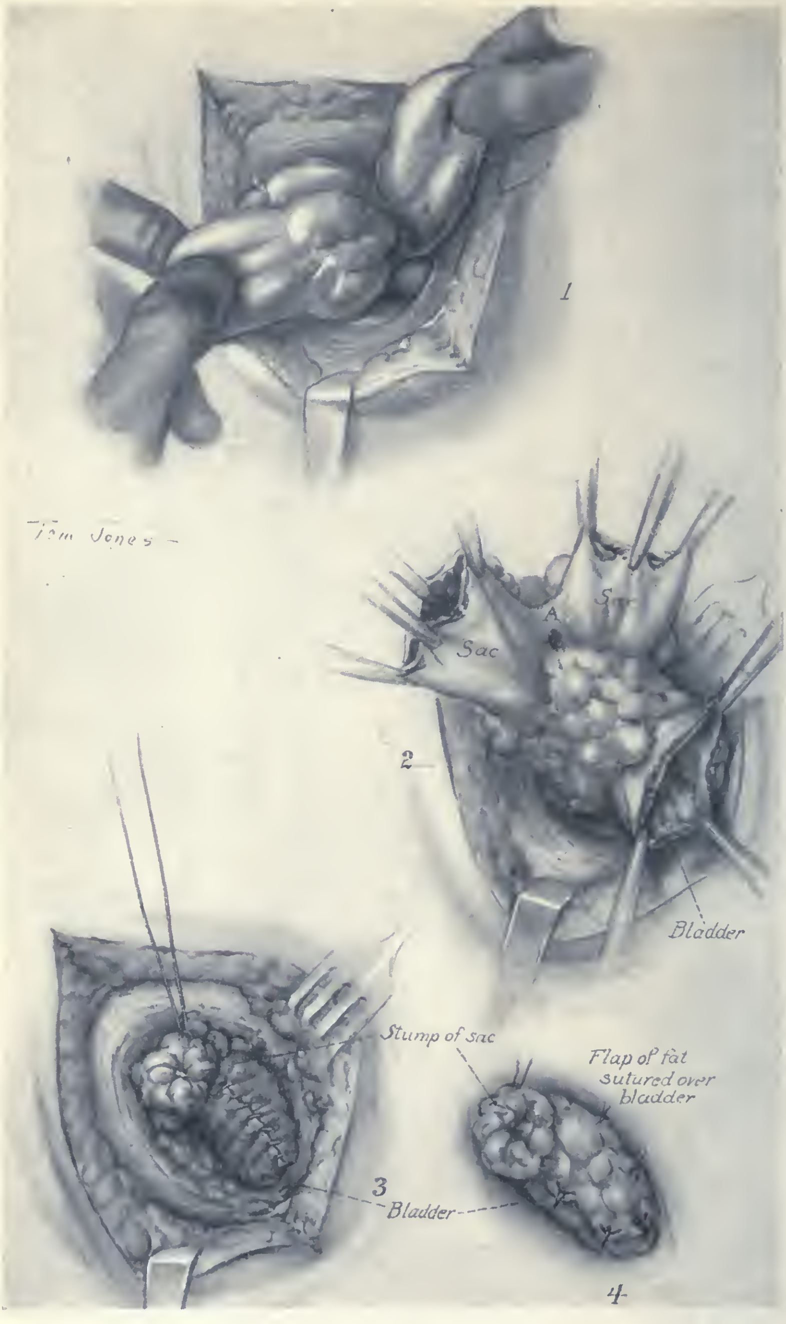
Note.—This patient left the hospital four weeks later completely cured, with no discharge from the hip, walking on a solid leg with the aid of a cane.

DIVERTICULUM OF URINARY BLADDER IN AN INGUINAL HERNIA

Summary: Operation on an irreducible hernia—discovery of a pantaloon sac lying side by side with a diverticulum of the bladder; treatment.

This patient, a lady of forty-five, has observed a tumor mass in the right inguinal region for some time. The tumor is painful and largest in size while she is standing; when on her back it is considerably smaller, but does not disappear entirely. The tumor feels irregular and is in certain ways connected with the skin, so that it cannot be pushed entirely back. Some portions of it seem to be harder than others. On coughing it is propelled outward, but not to a great extent. We find that we have to deal here with an inguinal hernia which is not entirely reducible. The only peculiar feature about it is that it is so irregular in shape and so much more toward the median line than we commonly see hernias. In every other respect the lady is well. Considering the pain the tumor causes her at times and the possibility of incarceration, we have decided on operation.

On dissecting the hernial sac we have a great deal of difficulty in locating the sac of the hernia because of the considerable amount of preperitoneal fat present. We find that the irregular shape was due to some indurated preperitoneal fat and a few lobules of adherent omentum within the sac, which we have finally dissected. It is one of those so-called pantaloon sacs or bifurcated sacs (Fig. 497, 1); on further examination of this sac it seems to us that toward the median line there is another sac, like a hernia coming through a small crevice in the abdominal fascia (Fig. 497, 2). This sac seems rather thick and has no preperitoneal fat, but its neck fills out the crevice in the fascia very tightly and does not allow any pulling forward nor pushing backward. The thickness of the wall makes us suspicious of the bladder, but as it has a real neck, it must, therefore, be, if a part of the bladder, a diverticulum of the same. Considering this



Tom Jones –

Fig. 497.

probability, we incise it, introduce a catheter, and find that it really is a diverticulum of the bladder. The sac of the hernia is now ligated, cut off and secured in the usual manner, the diverticulum is cut off at its neck and sutured by a continuous suture which does not pass into the mucous membrane, but keeps the thread in the muscularis (Fig. 497, 3). After the suture has been completed, a lobule of fat from the preperitoneal space is sutured over it to secure better continence of the suture (Fig. 497, 4). The wound is then closed with a silkworm-gut drain in view of the possibility of a urinary fistula.

Note.—An intra-urethral catheter (A'demeure) was left in place for eight days and the urine drawn off constantly. After the removal of the catheter the patient passed urine spontaneously every four to five hours. About fifteen days after the operation an abscess formed at the outer angle of the wound, a little bundle of catgut was discharged, and with it a stream of urine came for a few hours, whereupon we again introduced a catheter. This was left in the bladder for a few days, whereupon permanent closure of the fistula ensued.

Fig. 497.—1, Pantaloon sac in an inguinal hernia; 2, both legs of the pantaloon sac and the bladder diverticulum open preliminary to final closure; 3, hernial sac ligated in usual manner; bladder repaired by continuous over-and-over stitch; 4, line of suture in bladder wall reinforced by tab of fat.

GANGRENOUS HERNIA OF THE BLADDER AND INTESTINE

Summary: A patient, sixty-three years of age, with a large, postoperative, ventral hernia, repeatedly incarcerated and finally becoming strangulated with gangrene and sloughing of the overlying tissues; operative technic; postoperative course.

THIS old gentleman, sixty-three years of age, has been a sufferer from a large hernia for the past nine years. Many years before that he was troubled with bladder symptoms, and finally an operation was performed in a small town in Ohio for an enormous stone in the bladder. The stone measured 6½ inches in circumference and filled almost the entire bladder. A large breach in the bladder had been necessary and evidently a perineal section and urethrotomy had to be made at the same time. The patient made a very tedious and slow recovery after many months. At times it seemed as though he were breathing his last, but he finally recovered. The opening in the bladder closed and opened many times, but ultimately healed, leaving a large ventral hernia the size of a child's head, containing omentum, loops of intestine, and the bladder with the scar of the same attached to the scar of the abdominal wall. During the years that followed he suffered many times from urinary obstruction, during which it was necessary to use catheters. Many false passages were made, but he recovered from every one. Following the advice of his last surgeon, he objected to any kind of operative interference in later years, even when the hernia became temporarily incarcerated and gave him a great deal of pain. He finally became addicted to the use of morphin and thus he went on until the present time. He finally came under the observation of Dr. McG., who strongly advised a radical operation, seeing that the man's general condition was good and that there was a possiblity of curing him. He could not convince the patient of this and operation was refused.

A few days ago he was seized with violent pains in the hernia, and notwithstanding all careful methods the contents of the hernia could not be brought back into the abdominal cavity, and it was evident that the patient was suffering from acute strangulation of the hernial contents. Applications of moist warm dressings did not improve the condition, and on the second day it was evident that some important change had taken place in the hernia. A blister formed on the surface, the tumor of the hernia began to darken in color, and within a few hours it was evident that gangrene of the most acute character had set in. From the gangrenous mass was running an ammoniac, foul-smelling fluid, and the omentum, black-red in color and exuding disintegrating fat, appeared on the surface. In this condition I saw him at his home in consultation with Dr. McG. His pulse was regular, strong, and about 80 per minute. His features were drawn and he showed a slight stupor, though he could answer reasonably all questions. He suffered considerable pain although under the influence of a narcotic. The abdomen was not particularly distended, but one could see the peristaltic movements of the bowel through the wall of the abdomen. His bowels had not moved for two days. He belched, but did not vomit. The tumor itself, the size of a small child's head, showed superficial gangrene for about two-thirds of its circumference. The skin adjoining the gangrene was somewhat red and edematous from acute inflammation. From the gangrenous mass was running urinous, foul-smelling fluid (Fig. 498). We were sure that the bladder had become gangrenous also, and that the urine had begun to infiltrate the tissues of the hernia. One could distinctly outline and percuss intestinal coils in the hernia.

The prognosis under the present condition is absolutely fatal within a very short time. Operative prognosis is poor, but there is some chance of recovery. Of course, the procedure depends entirely upon the nature of the tissues and the contents of the hernial sac. Sepsis is almost sure to occur, nevertheless it is worth while to undertake an operation. We told the patient his chances; he agreed to the operation and was transferred to the hospital. It is now two hours since I first saw him.

Operation.—The hernial sac is walled off by gauze and towels, so that during the operation the fluid will not flow into the field of operation, and we can operate as much as possible within a clean area. We open the sac through a transverse incision above the gangrenous area and carry our incision around so as to enter the sac freely. We first meet with omentum. The free fluid within the sac has somewhat of a urinary odor, but not as bad as on the outside. It is carefully mopped out with salt water. The omentum is then divided between ligatures close to the ring of the hernia. We now find that there are three loops of intestine in the sac. With some difficulty they are pulled out from the sac; their surface is covered with a fibrinous mass, which can to a certain degree be peeled off, but not entirely—not enough to separate the bowel and make it free. The third loop of bowel belongs to the large intestine and has a dark spot which seems more dead than alive. Nevertheless it is not interfered with and we trust that it will revive. After returning the omentum and the three loops of intestine into the abdominal cavity, we find that we have in the lower portion

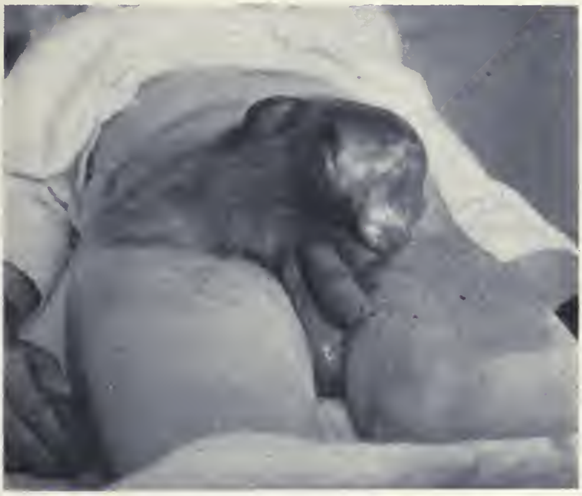


Fig. 498.—Just before operation; note extensive infiltration and edema of tissue surrounding the tumor.

of the sac the entire bladder with two distinct gangrenous ulcers of white color, through which urine trickles in the posterior wall. One ulcer is very near to the posterior lower surface and the other is higher up. The apex of the bladder forming the apex of the hernial sac is altogether gangrenous or semigangrenous.

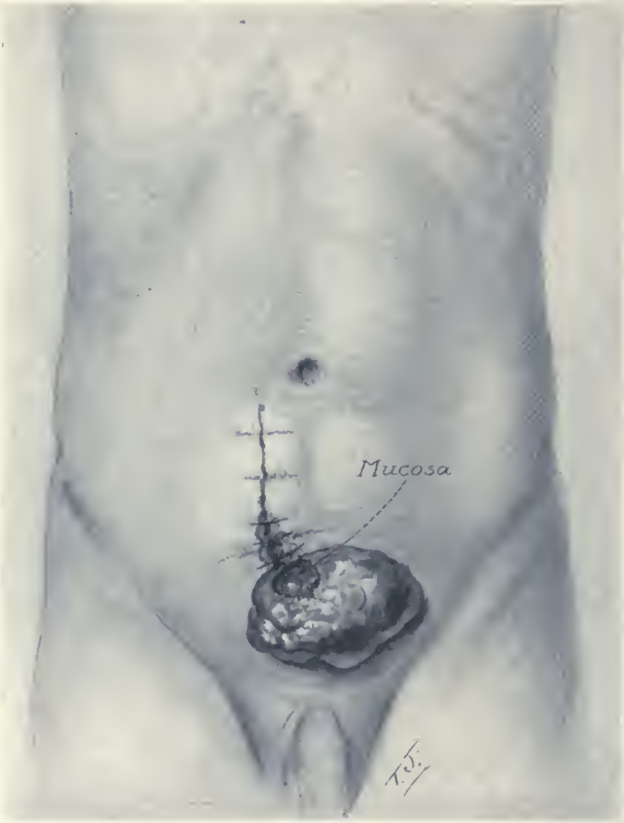


Fig. 499.—Two weeks after operation; the bladder still outside the body, the urine discharging through a large fistula.

Considering this condition, I think it advisable to leave the bladder outside the peritoneal cavity, and I therefore pass my first suture for closing the abdominal cavity through the peritoneum posterior to the bladder wall below the gangrenous portion to the other side of the peritoneum. I slip a long tube with gauze underneath this first ligature into the culdesac. The rest of the abdominal incision is then easily sutured. Thus the gangrenous portion of the bladder, as much as has not been cut away with the sac, remains extraperitoneal. We place the patient in bed in fairly good condition. A catheter is introduced into the bladder and suction is made so as to prevent the urine from flowing into the abdominal cavity until adhesions and a protecting wall have formed.

Postoperative Notes.—Contrary to all fears and expectations, the patient made a very good recovery. Shortly after operation his temperature fell from 100° F. to normal; his pulse remained near normal all the time. He did not vomit at all and the gangrene showed no tendency to spread. He had no signs of peritonitis, not even of peritoneal irritation.

Two weeks after operation: Most of the urine comes from above and keeps him saturated most of the time (Fig. 499).

Note.—Since the preceding note was made the bladder has sloughed off at the level of the skin, the patient urinates normally, and his fistula is healed.

CLINIC OF DR. JOHN R. HARGER

Cook County Hospital

ACUTE HYPERPLASIA OF THYROID WITH DYSPNEA

Summary: A patient, twelve years of age, complaining of marked dyspnea on exertion associated with rapid enlargement of the thyroid gland; diagnosis; dangers of palliative treatment; technic of operation under local anesthesia. Presentation of autopsy report, with demonstration of organs, from a neglected case.

The case today is one of unusual interest, first because of its extreme severity, and second, because of its rarity.

History.—The patient is a girl twelve years old, who enters the hospital with the complaint that about three months ago she noticed a swelling on the front of her neck, which has increased in size quite rapidly. For the past five or six weeks it has been tender to touch and has interfered with breathing. On several occasions she has had choking spells, especially after exertion, and now she is afraid to run or climb stairs for fear she will choke. She makes no other complaint, sleeps well, eats well, and is otherwise free from distress. Her sister informs us that she has not yet menstruated, but we note considerable development of the mammary glands.

Past history is entirely negative as to anything that might influence the present condition.

Family History.—The mother of the patient has had a goiter of moderate size for several years, and a sister of fourteen has had a small goiter since birth.

Examination.—You can see a moderate enlargement in the region of the thyroid gland. It is fairly uniform, a little larger on the right side, comparatively soft, and moves with the trachea during deglutition. When I produce pressure on the lateral lobes toward the midline the patient immediately shows signs of distress in breathing; especially is this true of inspiration; and when I press with my thumb on the anterior surface of the mass breathing is perfectly free. Those of you who are close enough will notice that when the patient is entirely undisturbed she has a slight inspiratory wheeze. These findings indicate that the lateral lobes of this thyroid are producing sufficient pressure upon the trachea to cause it to collapse laterally and thus interfere with respiration.

This mass does not extend down behind the sternum, but can be raised entirely above it, and pressure on the anterior surface tends to relieve dyspnea rather than increase it.

There is no tremor, exophthalmos, or tachycardia. The pulse is now 80, respirations 20, and temperature 98.2° F. The heart and lungs reveal no abnormalities.

Diagnosis.—The diagnosis here seems quite clear and we are forced to conclude that we are dealing with an acute hyperplasia of the thyroid gland, and that the surrounding tissues of the neck have not been able to accommodate themselves to this new condition, and thus undue pressure on the trachea is produced. The tracheal rings in a child of this age are very soft and offer but slight resistance to this sudden increase in pressure, and therefore collapse. That the trachea has collapsed laterally is evidenced by the immediate increase in dyspnea when pressure is exerted over the lateral lobes.

Prognosis.—Some of you have already considered the prognosis in this case, and the question of treatment enters into it at once. I want you to see that the prognosis here is very grave unless this patient can be kept under strict supervision day and night, or be operated on now and given relief from this distressing condition. It is in just this type of case that the patient may be awakened in the middle of the night by sudden closing of the trachea. Extreme dyspnea and cyanosis appear immediately and death is imminent, for when this acute stage arrives, unless immediate relief by tracheotomy is at hand, the patient must succumb.

Treatment.—The patient has been under the supervision of a skilled pediatrician for the past four weeks, and yet her condition has gradually become more alarming, therefore I feel that immediate operation is indicated.

Anesthetic.—The question of an anesthetic is a very important one here and every precaution must be taken to guard against a possible increase in the dyspnea. We already have a very small passageway in this trachea and a prospect of its being distorted and pressed upon during the operative procedure faces us if we dare risk the dangers of a general anesthetic. We could pass a catheter into the trachea and introduce the anesthetic through it, but I do not believe that is indicated, for I feel confident that I can remove all the gland that is necessary under local anesthesia.

Operation.—As the patient is only twelve years old and of medium size, I have given her only $\frac{1}{6}$ grain of morphin before coming to the operating-room. I will now block off the thyroid region by using a 1 per cent. solution of apothesine. A $\frac{1}{2}$ to 1 per cent. solution, without adrenalin, will do the work, and I therefore refrain from using anything stronger. It is not essential to inject the solution intradermally, nor does it require injection into the deep tissues of the neck. All that I will do is to infiltrate the subcutaneous tissues thoroughly well back from the field of operation, which in most instances will so block the nerve supply to the part that all sensation, both superficial and deep, will be entirely cut off. I usually have 3 or 4 ounces of the solution prepared and then use it *ad libitum.*

I will now inject a line from the angle of the jaw (Fig. 500) downward across the sternomastoid to a point near the middle of the clavicle. The other side I will treat in the same way and then connect these two lines by injecting along the under surface of the jaw and the upper margin of the clavicles.

I will now make the usual incision extending in a semicircular direction about 1 inch above the clavicle and allow it to extend well toward each lateral margin of the gland. By dividing and retracting the overlying tissues I soon reach the capsule. It will not be necessary to divide the muscles as, you see, they can be readily drawn aside. The capsule is being removed with the overlying tissue, so that I can use it to cover the cut surface of the gland that is allowed to remain. I will now remove enough of this gland to relieve the pressure. To remove a wedge-shaped piece from each lateral lobe would not be sufficient. I am now removing practically the anterior half of the right lobe. I will take with it the midlobe and about an equal amount of the left lobe. Please note that there is comparatively little hemorrhage. It is apparent now that the pressure upon this child's trachea will be relieved to a great extent by the removal of so much of this gland, and we must not forget that the remaining portion will, after the period of adolescence, undergo a certain amount of retrogressive change, and if we remove too much the patient will eventually manifest symptoms of hypothyroidism. By removing the anterior half of each lobe we have avoided all danger to the recurrent laryngeal nerves and the parathyroids, and have not materially disturbed the blood-supply to the thyroid itself.

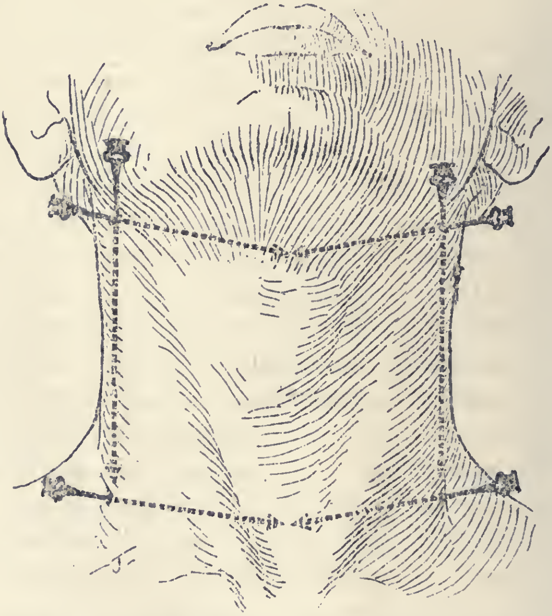


Fig. 500.—Area of anesthesia produced by injecting anesthetic subcutaneously and well outside of the operative field.

After tying a few of these bleeders I will cover the cut surface of the gland by closing the capsule and superficial tissues and insert a cigarette drain into the most dependent portion of the wound.

Now I want to call your attention to a few facts of especial interest in this case. The child complained of pain when I first began to inject the anesthetic, but when I explained to her what I was doing and that if there was no more pain she should lie quietly and keep still, she quieted down immediately. You noticed that when I made the initial incision she complained when the knife reached the extreme left end of the cut, but after that she never moved nor made complaint, and yet we proceeded with the operation just the same as though the patient were in deep narcosis. There was no disturbance with her breathing during the operation and she is now able to smile at you, and I think her condition is quite different from what it would have been if a general anesthetic had been administered.

Pathologic Report.—Simple goiter showing rapid proliferation and increase in the follicular structures.

After-treatment.—The patient left the hospital the fourth day, at which time it was noted that she manifested a few symptoms of hyperthyroidism, which were no doubt due to the increased absorption from the cut surfaces of the gland. These symptoms soon disappeared and the patient made a complete recovery and is now in excellent condition.

Report of a Similar Case.—If you will give me your attention for a few moments longer I want to give you an abstract of a similar case that was in part under my care only recently, and which, because of delayed treatment, ended disastrously.

History.—A boy aged fifteen entered this hospital complaining of difficulty in swallowing and breathing and some pain in the neck. He states that he was perfectly well until two or three weeks ago, when he caught a slight cold and had a mild cough. Up to that time he had no difficulty with respiration or swallowing. At that time he noticed on awakening some pain in his neck and he was unable to breathe as well as usual; the pain in the neck was increased by swallowing. Two days ago (November 24, 1918) he noticed that his collar was too tight and there was some swelling of the lower part of his neck.

Past and family histories were negative.

Physical examination was entirely without interest except for the condition of his neck and throat. There was a very moderate enlargement in the region of the thyroid gland, the left lobe being especially palpable. The mass was firm, rather low in the neck, and moved, with some pain, on swallowing.

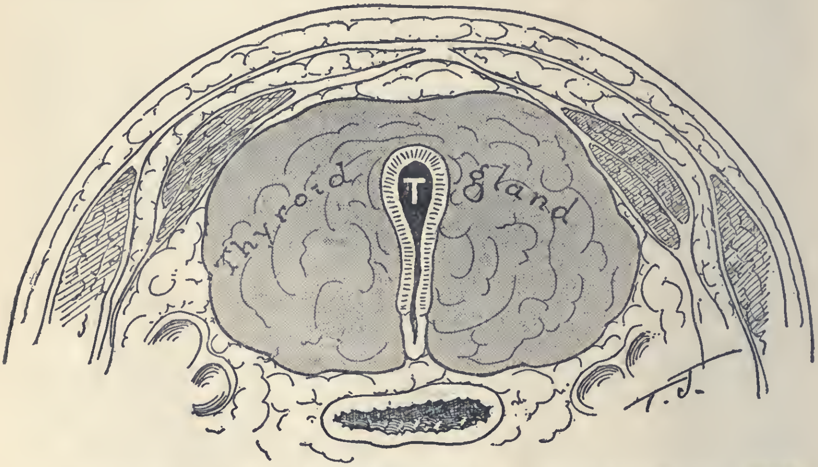


Fig. 501.—The thyroid enlarged so rapidly that the surrounding tissues could not accommodate themselves to the rapid increase in pressure. The tense overlying fascia and muscles thus aided in the collapse of the trachea. The breathing space was limited to the narrow tract (*T*) anteriorly.

Subsequent History.—The patient entered the hospital at 1.30 in the afternoon, at which time his temperature was 99° F., pulse 82, and respirations 20. He appeared uncomfortable and breathed with some difficulty. During the early hours of the night, about eight to ten hours after his entrance, his breathing became more distressed. This condition gradually grew worse until about 2 A. M., when, morphin and hot inhalations not having given relief, the house physician, Dr. Cushman, attempted intubation. Failing in this, she attempted tracheotomy, but because of the goiterous mass and the collapsed condition of the trachea this also failed. About 3.30 A. M. I responded to a call and found the patient in extreme dyspnea and very cyanotic. I immediately made an incision in the neck just above the sternum and found the trachea collapsed laterally. A large tube was inserted and the patient soon breathed with ease. I then advised partial thryoidectomy under local anesthesia for the following day. He then passed from my care and operation was refused him. Three days later the tracheal tube was removed under ether anesthesia and a smaller one inserted, after which he developed bronchopneumonia and died.

Postmortem examination disclosed marked diffuse hyperplasia of the thyroid gland, surgical tracheotomy, and lobular pneumonia.

We have here the gross specimen of the thyroid gland with the trachea. Please note when I hold this up that the lateral lobes are very large and firm and that they have caused the trachea to collapse laterally, so that there is no opening left except a small one near the anterior portion of the original canal where the tracheal rings succeed in maintaining slight separation (Fig. 501).

CLINIC OF DR. KELLOGG SPEED

Cook County Hospital

ELEPHANTIASIS NOSTRAS

Summary: Presentation of patient with elephantiasis of the scrotum; technic of removal of excess tissue and re-establishment of lymph drainage; clinical varieties of elephantiasis; etiology of elephantiasis nostras—importance of streptococcic lymphangitis—pathologic anatomy—clinical symptoms and course.

This patient, a colored man, is married, forty years old, and a porter by occupation. He complains of swelling of the scrotum. Beginning five years ago the patient suffered from suppurating adenitis in the right groin, for which several drainage incisions were made. Deep, thickened scars resulted, and three years later, following similar suppuration in the left groin and multiple incisions, he developed small ulcers of the scrotum and infection of the scrotal tissues. The penis and scrotum became greatly swollen and have continued to enlarge, gradually reaching the present size (Figs. 502, 503).

Two years ago, following sores on the glans and a urethral discharge, stricture of the urethra developed, for which external urethrotomy was performed at the front of the enlarged scrotum at the base of the penis. Through this opening now passes about two-thirds of the urine, the rest coming via the meatus. A year ago he had a blood examination made, the result of which he does not know, but he was given one injection in his arm of a medicine he thinks was 606.

His past history, except for the venereal disease mentioned, is negative. His wife, from whom he has been separated for eight years, is living and well, as are also three children. A general physical examination on admission to the hospital was negative except the genitalia and adjacent regions. There was no general adenopathy. Urine and blood examination revealed nothing abnormal. The Wassermann test was negative.

The inner side of the groins and the inguinal areas where incisions had been made to drain the suppurating adenitis presented several deeply retracted thickened scars with a tendency to keloid formation. These were mostly transverse to the long axis of the body. The skin covering the penis was very thick, slightly edematous, and covered the glans so that it could not be retracted. There was no balanitis or paraphimosis. The scrotum was very large and heavy. The skin was mottled with pinkish spots in the area between the thighs and toward the perineum. Although it felt edematous, it could not be pitted, the surface being liberally spotted with wart-like outgrowths or

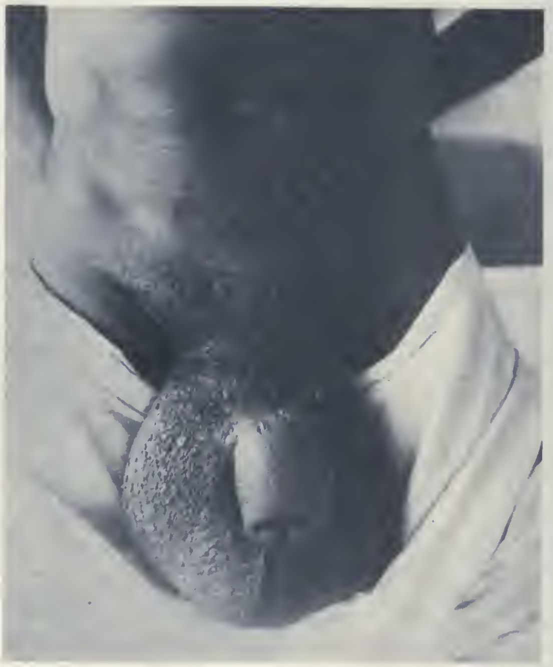


Fig. 502.—Elephantiasis of scrotum due to blocking of lymph channels by scar tissue subsequent to suppurative inguinal lymphadenitis.

thickenings. There were no ulcers on the scrotal skin surface. An external urethrotomy opening existed at the base of the penis on the anterior scrotal margin where the penile tissues had been cut through. The urethra was here patent, only its superior wall remained, the lower wall having flared out and been retracted by the skin. The patient had no edema of the legs and feet or of the abdominal skin wall above the pubes. The scrotal mass had become so large that the patient could not walk comfortably.

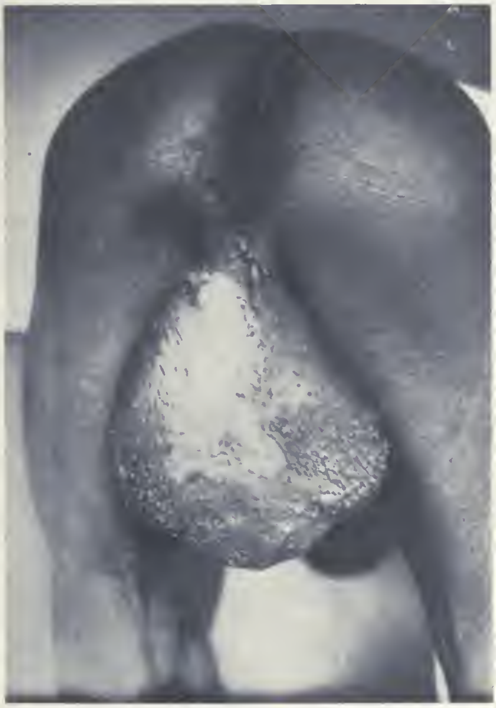


Fig. 503.—Elephantiasis of scrotum due to blocking of lymph channels by scar tissue subsequent to suppurative inguinal lymphadenitis.

After his admission he was put to rest in bed to determine how much of the scrotal swelling was edema resulting from position. We found that after several days the mass decreased in size from one-fourth to one-third. After waiting eighteen days I decided to attempt an investigation of his urethra to decide whether he was leaking any urine into the scrotal tissues. On June 20th, under ether anesthesia, the urethra was sounded. An anterior stricture between the urethrotomy opening and the bulb was found. To pass this and get into the bladder I had to perform a perineal urethrotomy behind the large scrotum. The prostatic portion of the urethra was normally patent. An inlying catheter was placed in the bladder and an attempt was made to get the bladder in good condition by free drainage and tonic irrigation. Seventeen days later, the deep urethrotomy wound being closed, a plastic on the old anterior opening was performed under local anesthesia. It was hoped that a flap of penile skin could be turned over this opening after freshening the edges so that the lower wall of the urethra here open could be rebuilt and the flow of urine could be directed out through the normal penile meatus. A new inlying catheter was left in place. The penile skin was very tough and thick, and although the flap covering lay in apposition to cut edges without tension it gradually sloughed and had to be sacrificed. So much for the nutrition and health of this thickened skin.

It was my desire to close this urethral opening before doing a resection of scrotal tissues to avoid the possible contamination of the large wound which would result from excision of this mass. However, after some further rest in bed and bladder irrigation, the urine being quite clean, I let the patient get up, and we were able to teach him to urinate in a standing position so that he did not soil his scrotal skin.

Today, over two months since his admission, I feel ready to perform an operation to reduce the size of the scrotal tissues. Choosing the median raphé as a guide, we will cut through this very heavy skin from within a short distance of the penile base down toward the perineum. This entrance is chosen for two reasons. We expect to find in the path of the raphé where the two scrotal halves have fused a minimum number of blood-vessels. As I go deeper this path will also be a guide to the testes, which I must first find and isolate before cutting away any tissues. As I go deeper we pass through this thickened epidermis and come to tissues of the dartos that are extremely edematous, almost like soft gelatin. This is the great increase of collagen which is characteristic of elephantiasis, and of which I shall speak again. With no great difficulty I first isolate the right, then the left, testicle, lying rather high up near the anterior portion of the scrotum. The cords are separated for about 3 inches and the testicles can now be held up out of the way by gauze slings. They are quite normal in size, a little soft; their lymphatic drainage has not been interfered with; it goes to the sacral and lumbar glands via the cord.

The next step consists in cutting away an elliptic portion of this thick mass on each side of the long incision. I must not cut away too much because this thick skin has no elasticity, and if my closing stitches are under too great tension they will slough through. I cannot undermine this skin up toward the thighs because it is tough, adherent, and poorly nourished, and I must also leave flaps large enough to cover the testicles to form a new scrotum. The edematous connective tissue beneath the skin is taken away with it. I have now removed two large pieces, one from each side; they weigh several pounds.

In addition to the amputation I wish to provide new and additional drainage for the new scrotum; there is no doubt that the enlargement has been caused by a blocking of lymphatic channels leading from the skin to the inguinal glands. This blocking has been caused by the multiple incisions to drain the suppuration of the inguinal glands, contracting scars having formed, and also by the streptococcic inflammation of the scrotal tissues and lymphatics.

To attempt to provide a path over which new lymphatic drainage can develop I shall pass braided silk strands about 12 inches long from the scrotal tissues up subcutaneously to the abdominal skin above the pubes. Three such strands of silk are inserted on each side, one by needle insertion close under the skin and the other two through the subcutaneous tissue into a tunnel made by a 12-inch forceps thrust upward. Small abdominal incisions over the forceps ends allow me to pull the threads down to the scrotal edge. Along the course of these threads I expect to provide for the escape of lymph from the tissues of the new scrotum, the drainage into the abdominal tissues following normal paths. I could insert narrow rubber tubes here, but they would surely disintegrate after due time even if they remained aseptic, and it seems much better not to leave such large foreign bodies in the tissues.

We are not dealing with elephantiasis caused by filaria, but with one caused by lymphatic blocking by scar tissue based on a suppurating streptococcic inflammation. This man has never been exposed to tropical filaria, he has never been south of Washington, D. C.

I am convinced that we see elephantiasis of this type frequently enough, usually in a beginning stage, often overlooked and passed on until radical surgical measures become indicated. On that account it is worth while to consider the matter of lymphatic blocking and resulting hypertrophic conditions before we make incisions for inguinal or other abscesses. Every skin incision should be carefully planned to avoid disagreeable results either from scar, loss of skin sensation, lymphatic blocking, or severance of deeper nerves and blood-vessels. Within the last week I have seen a soldier returned from France who had a small piece of shrapnel in his cheek near the angle of the jaw. A surgeon, operating for removal of the metal, had made an incision just in front of the parotid gland in a vertical axis and severed all the lower branches of the facial nerve on that side, with resulting paralysis.

Let us inquire somewhat into elephantiasis because this case is an example of the acquired type which is not filarial in cause. Hutchinson said that whatever causes obstructive inflammation of lymphatic vessels may produce elephantoid hypertrophy of any dependent part. He also said, "There is no such disease as true elephantiasis as distinct from the forms which are false" (Polyclinic, London, 1904, viii, 22).

A simple classification was presented by Neisser and Jadassohn in 1901 which we can adopt:

"(1) Elephantiasis nostras—after venous stasis with purulent inflammation and connective-tissue hyperplasia of the lymph-vessels. This occurs particularly after erysipelas (streptococcus infection).

"(2) Elephantiasis of tropical regions (filarial elephantiasis).

"(3) Elephantiasis-like tumors composed of connective tissue which occur as congenital deformities in contrast with (1) and (2), which are acquired."

The etiology of elephantiasis nostras has been the cause of considerable controversy in the literature. Hastings[1] reviewed the discussions and concluded that it corresponded to the elephantiasis dura of Virchow. He mentions Bryk,[2] who reported 2 cases after erysipelatous abscesses, and the monograph of Nieden (1882), who considered the cause of elephantiasis minutely, believing that it depended on lymphangiectases following inflammation. The lymph-glands and vessels take part in the initial erysipelatous skin inflammation; thrombosis of the lymph-vessels results and blocking of the lymph-glands accounts for the mechanical stasis of the lymph. The superficial skin and adjacent tissues retain their metabolic waste products, which cause irritation and lead to hyperplasia. Virchow favored this order of lymph-vessel obliteration, but Werner took the stand that the lymph-vessels were never blocked; they simply became varicose and elephantiasis was secondary to that phenomenon.

For clinical purposes we believe that elephantiasis nostras results from chronic or recurrent inflammations combined with lymph- and blood-vessel stasis. It follows chronic skin conditions such as syphilitic inflammation, simple ulceration, eczema, lupus, erysipelatous lymphangitis (streptococcic inflammation), and phlebitis. A contributing factor may be found in pressure from contracted scars and adhesions due to trauma. Hence, lymphatic elephantiasis is defined as chronic progressive enlargement of a portion of the body, the result of hyperplasia of the connective tissue of the skin and subcutaneous tissues aided by hyperplasia of the lymph-vessels and chronic edema of the affected area.

The condition is not extremely uncommon in the labia of the female. Croom[1] cites an instance of labial elephantiasis following lymph blocking in the groin due to tuberculous glands. Grieg[2] reported enlargement of the labia, the result of chronic edema from lymphatic blocking. Because there were no telangiectases and no alteration in color he considered that there was no interference with venous circulation. His patient, a nullipara, forty-three years old, suffered with spastic contractures due to cerebrospinal sclerosis, causing forcible approximation of the thighs. There was no history of inflammation or infection of the labia, but the skin had the same distinctive nodular appearance as the patient shown you. Kelley[3] reported a case of unilateral labial enlargement.

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[1] Jour. Amer. Med. Sci., 1906, 397.

[2] Oesterreich Zeit. f. Heilkunde, 1869, 469.

In 1916 Walther[4] reported an elephantoid enlargement of the right leg of a patient resulting from cicatrices in the groin, coupled with chronic lymphangitis. He obtained great improvement by implanting a rubber tube deep in the tissues to help drain the lymph from the leg to the abdominal wall. Thiery[5] also recorded such a leg condition in a man forty-six years of age, who had never left France nor had filariasis. The patient suffered from varicose veins of the leg starting at fifteen years of age, and had numerous ulcers and eruptions which resulted in his right leg being twice the size of the left at the knee. Amputation was performed and some time later the remaining leg began to show signs of elephantiasis.

Busey,[6] in his series of articles on the lymphatics in 1876, discusses non-parasitic elephantiasis. The congenital forms, which he believed were local and occurred most frequently in acephalic and other monsters, were the results of congenital nutritional defects, the preliminary changes taking place during intra-uterine life and being aided later by some acquired factor such as local inflammation. The acquired form he believed involved both the blood-vessels and lymphatics, probably the lymphatics primarily. The lymphatic effusions resulted in hypertrophy of the subcutaneous tissues, possibly extending to and involving the other soft tissues or even the bony structures.

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[1] Trans. Edin. Obstet. Soc., xviii, 144.

[2] Edin. Med. Jour., August, 1916, 111.

[3] Oper. Gynecol., vol. i, 181.

[4] Bull. et Mem. Soc. de Chir. de Paris, 1916, N. S., xlii, 1691 and 1996.

[5] Loc. cit., p. 1000.

[6] New Orleans Med. and Surg. Jour., 1876, 307.

Elephantiasis nostras became better understood after Sabouraud's work in 1893. He made cultures from the skin during the erysipelatous attacks affecting an elephantiasic extremity and obtained a pure culture of streptococcus, whereas cultures taken between attacks were sterile. Many observers have considered that a syphilitic infection was contributory to the streptococcic inflammation. McDonagh[1] reported one scrotal case and Adamson[2] and Shattuck[3] reported 3 patients who had elephantiasis, the first one a leg which offered no cord-like enlargement of the veins or lymphatics and had a negative Wassermann and filaria were absent; the other 2 involved both scrotum and legs and had distinct erysipelatous attacks.

Recently Elliott[4] has described a case of elephantiasis nostras occurring in a nineteen-year-old girl who had an ulcer and erythematous attacks in her left arm following vaccination which confined her to the hospital for three months. Over a year before she reported, her left arm began to swell and became red and warm about 6 inches below the acromion, with no traumatic cause and no pain. The back of her hand became puffy and the skin became mottled and twice as thick as that on the right hand. At the time of Elliott's report the skin was described as not fixed, dusky red in color, with wart-like lesions on both surfaces of the hand, and an incised wound yielded a lymph-like material when squeezed. Streptococci were found during the erythemal attacks. A biopsy of a piece of skin gave microscopic findings as follows: The horny layer of the skin was twice as thick as normal, the rete about normal. There was no inter- or intracellular epidermal edema and the individual cells of the epidermis were normal. The papillæ were flattened and there was great increase of collagen in the corium extending deeply into the subcutaneous fat areas. The arterial blood-vessels showed great proliferation of their endothelium, the capillaries were obliterated by endarteritis, whereas the lymph-channels were dilated, but their walls were not thickened.

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[1] Brit. Jour. Derm., 1912, 225.

[2] Ibid., 1910, 1611.

[3] Boston Med. and Surg. Jour., 1910, 107.

[4] Jour. Cutan. Dis. including Syph., 1917, xxv, 17–25.

The early symptoms of elephantiasis nostras may be described as recurring attacks of erythema, the initial attack of which is often severe, edema and lymphangitis accompanying the erythema. After some days the skin inflammation subsides and the edema persists; hypertrophy of the subcutaneous connective tissue occurs in the meantime and thus elephantiasis is inaugurated. Daniels[1] states that elephantiasis may follow single or multiple attacks of erythema, or there may be no associated erythema whatsoever. Pressure-pain is the second most constant symptom and constitutional disturbance is often wanting.

Elliott concluded that the streptococcus is the cause of elephantiasis nostras and that the primary pathologic changes are in the blood-vessels rather than the lymphatics. Lymphatic stasis is a secondary change and there results edema, great increase of collagen, with some infiltration of small round cells and polymorphonuclear leukocytes. The condition must be differentiated from scleroderma and leprosy.

Whether the primary changes affect the blood-vessels or lymphatics, we should be careful in drainage incisions not to cut off main lymphatic trunks to dependent portions of the body, and if erythematous inflammation in these parts occurs we should be on guard against a resulting elephantoid hypertrophy. Hot dressings, rest, and other local measures must be adopted in streptococcic infections. If the hypertrophy has already developed, we can excise and offer some means for lymphatic drainage, such as threads or buried tubes, if the affected parts are important.

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[1] Brit. Med. Jour., 1908, 1359.

CLINIC OF DR. VERNON C. DAVID

PRESBYTERIAN HOSPITAL

INCONTINENCE OF THE RECTAL SPHINCTER

Summary: Incontinence of rectum resulting from improper postoperative management of a case of fistula in ano; technic of repair of external sphincter.

NINE months ago while in the army this patient, who is twenty-four years of age, developed a large, acute ischiorectal abscess on the left side, which was drained. Subsequently a fistula developed, which was operated and the tract laid open into the rectum, cutting the external sphincter muscle. The wound was tightly packed with gauze and, according to the patient's statement, this packing was not removed for ten days. The fistula eventually healed, but a deep depression, running into the rectum and impinging to some extent on the internal sphincter, remained. The divided halves of the external sphincter could be felt beneath the skin on each side of the scar. Since the operation the patient has had practically no control of his bowel movements and he soils his clothes a number of times a day. There is no history of lues, gonorrhea, or tuberculosis.

On rectal examination a defect, in which the index-finger can be laid, runs into the rectum from the left ischiorectal fossa. On either side of this depression, which represents the scar of the healed fistula, can be felt small bunches under the skin which are the cut ends of the external sphincter muscle. In attempting to voluntarily contract the sphincters these cut ends retract, demonstrating that the purse-string action of the muscle is lost. On internal rectal examination the internal sphincter is intact, but involved in scar tissue on the left quadrant. There are no sinuses present.

In considering this case attention should be drawn to the inadvisability of packing a newly operated fistulous tract tightly and in leaving the packing in place for a number of days. This procedure mechanically separates the cut ends of the external sphincter and, maintained for a number of days, makes a large defect in the soft parts which is replaced by a dense mass of scar tissue. A single layer of vaselined gauze is sufficient packing to prevent adherence of the freshly cut tissues, and if the wound

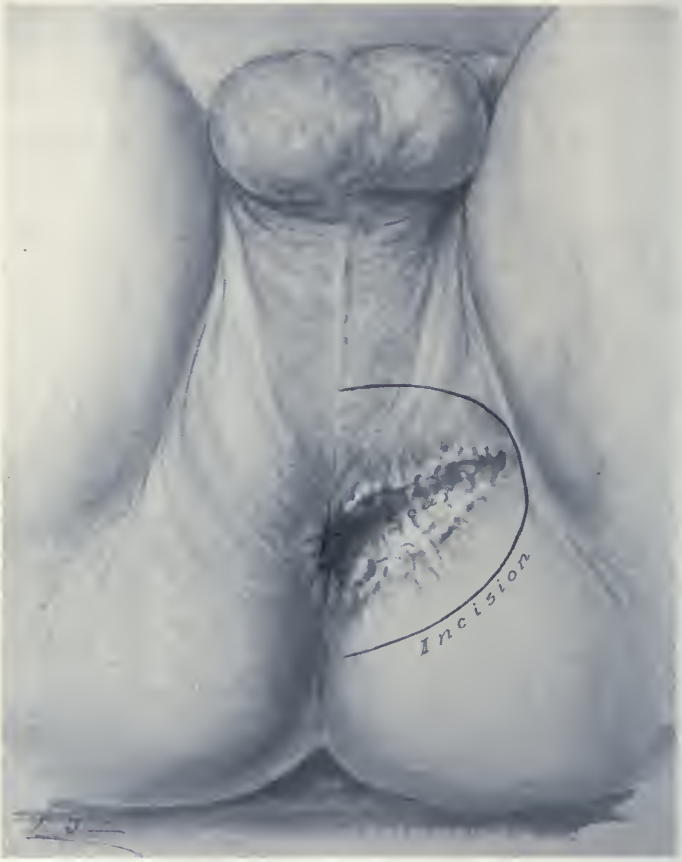

Fig. 504.—Deep scar at site of old fistula, interrupting the continuity of the external sphincter muscle and destroying the function of both sphincters of the rectum. Note line of incision carried wide of the anus.

is dressed each day after the operation it is easy to keep the wound healing from the bottom by gentle separation of the soft

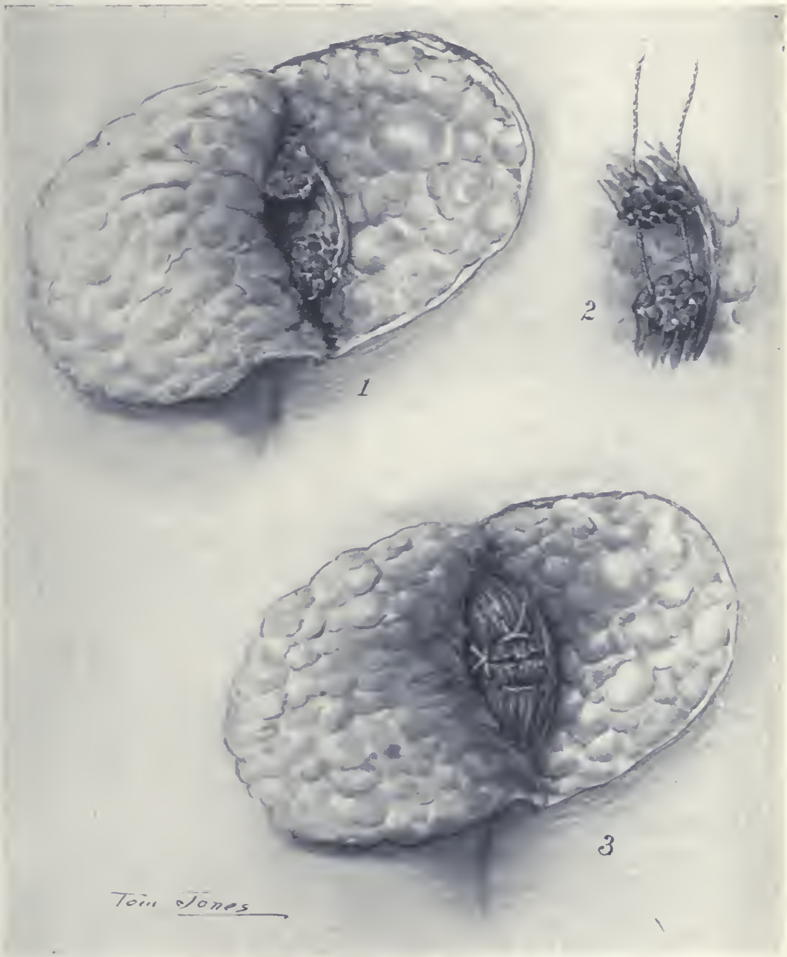

Fig. 505.—Flap turned down, cut ends of external sphincter muscle exposed and approximated by mattress sutures of chromic catgut.

parts by a probe. When the fistula has healed the scar tissue is then linear and the sphincter muscle is able to contract and narrow the anal opening. Another feature of this case is the presence of incontinence with an intact internal sphincter. In the great majority of cases the internal opening of a fistula in ano is at the mucocutaneous junction which is between the internal and external sphincters. Unless a large defect is made in the external sphincter the internal muscle is able to maintain continence. In this patient a large defect filled with scar tissue as well as involvement of the internal sphincter by scar tissue is responsible for its faliure to compensate for the lost action of the external muscle.

Operation.—Under local anesthesia a semicircular incision from the tip of the coccyx to the perineum is made, keeping about 4 inches away from the anus (Fig. 504). This incision gives ample exposure and is far enough away from the anus to prevent soiling of the wound during convalescence. A flap is now turned up toward the anus until the fibers or cut ends of the external sphincter appear (Fig. 505, 1). The ends of the cut muscle are freshened and sewed together by interrupted mattress sutures of chromic gut (Fig. 505, 2, 3). If it is desirable to decrease the circumference of the anus more than an end-to-end suture of the muscle accomplishes, additional lateral sutures angulating the muscles may be put in. The wound is closed with interrupted silkworm-gut.

The bowels will be confined for two or three days. They will then be caused to move daily by the use of oil-retention enemas, to be given an hour before a bowel movement, and the liberal administration of mineral oil by mouth.

Postoperative Note.—The wound healed by first intention and there was complete restoration of rectal continence.

RECTOVAGINAL FISTULA

Summary: Demonstration of fistula and technic of curative operation.

This patient, Mrs. McK., is forty-two years of age. One year ago she had an abscess in the posterior wall of the vagina following a fall against the edge of a bath-tub. This abscess was opened in the hospital and ever since the patient has had a discharge of gas and feces through a small opening on the posterior wall of the vagina. She has had two operations for the repair of this fistula, but in neither instance has there been a successful result. There is no history of lues, gonorrhea, or tuberculosis, and in every other respect the patient is in good health.

On examination by rectum a small opening is found on the anterior wall at the mucocutaneous line, which admits the tip of a small probe. This probe can be passed into the vagina through an opening on the posterior wall about 1 inch behind the perineal body (Fig. 506, 1, 2).

Operation.—Using ½ per cent. novocain solution, the sphincter muscle and posterior vaginal wall are anesthetized and a tubular dissection of the fistulous tract from the vaginal side down to the submucosa of the rectum is made (Fig. 507, 3). As the rectal opening is usually somewhat retracted due to scar tissue contraction, it is well to mobilize the submucosa for a distance of ½ inch around the rectal opening of the fistula. This will prevent difficulty in turning the fistulous tract inside out into the rectum (Fig. 507, 4). A linen ligature is tied around the base of the fistulous tract which hangs loose in the rectum and the redundant portion of the tissue beyond the ligature cut off (Fig. 507, 5). The vaginal defect, which is now in relatively healthy and uninfected tissue, is closed by two or three layers of interrupted catgut stitches.

Postoperative Note.—The bowels were confined for three days. At the end of this period the patient was allowed up and went

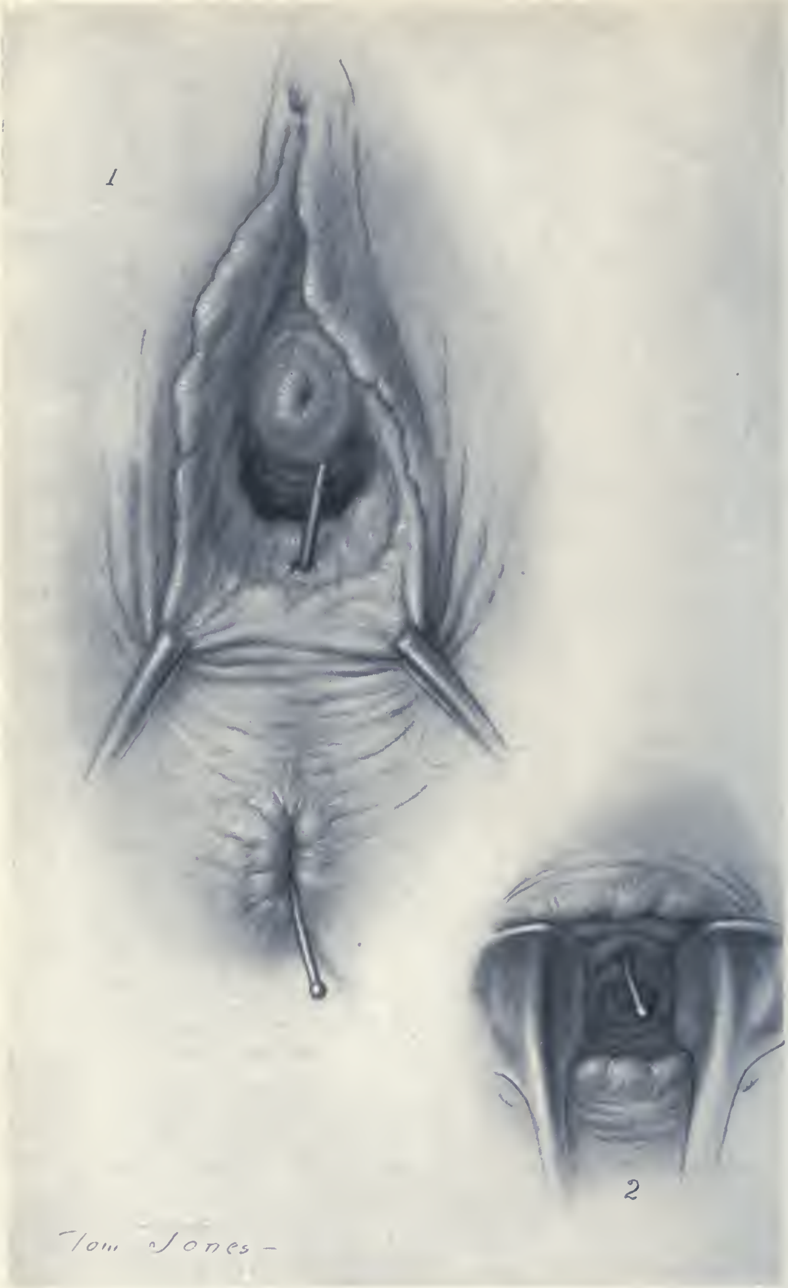

Fig. 506.—Probe along fistulous tract demonstrating (1) vaginal and (2) rectal openings.

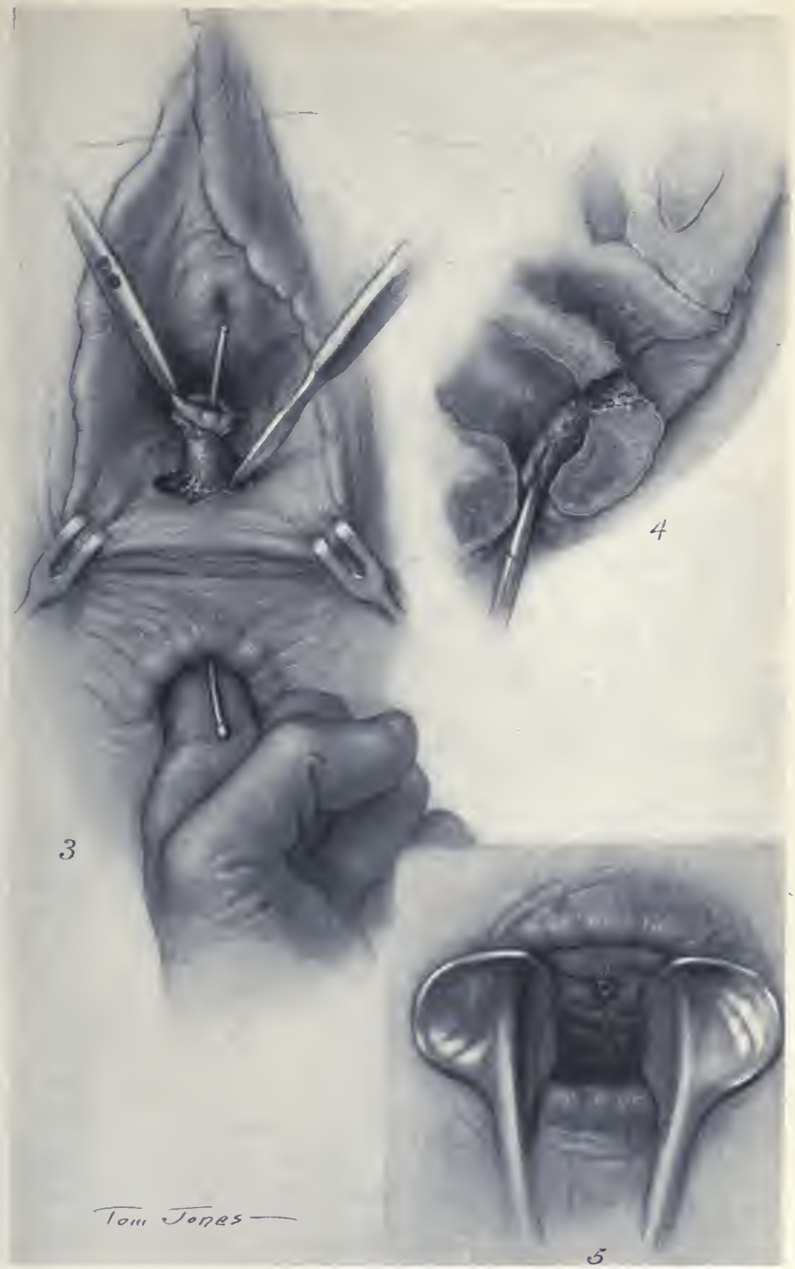

Fig. 507.—The infected tract is dissected out from the vaginal side down to the mucous membrane of the rectum (3). It is then inverted into the rectum (4), the base ligated, and excess tissue cut off distal to the ligature (5).

home shortly afterward. Examination six months later disclosed little evidence of her former trouble.

The advantage of this operation is that the whole infected tract is dissected out and inverted into the rectum, which allows primary closure of the vaginal defect. No plastic operation dealing with fistulous tracts around the rectum, bladder, or vagina is always successful, but I think the relative simplicity of this one, coupled with the good result obtained in this case, recommends it.

CLINIC OF DR. GATEWOOD

PRESBYTERIAN HOSPITAL

LACERATED WOUND OF BUTTOCK

Summary: A patient admitted for treatment two hours after receiving a severe lacerated wound of the left buttock; principle of treatment of wounds during period of contamination; technic and results in present case.

THIS seems like a morning of emergency surgery. This man has just been brought into the hospital from his place of work. He is a tank-builder, thirty-three years old, and a Finn by birth. He does not speak much English, but from his employer we learn that about two hours ago, while helping load a motor truck, he slipped and was caught by some sort of a heavy drill. This tool had a sharp point and tore through the clothing over the left buttock and into the flesh. There was considerable bleeding and a first-aid dressing was applied without making any attempt to sterilize the wound. As we remove this dressing we find a ragged lacerated wound of the left buttock about 25 cm. long, extending diagonally upward and outward. There is still some oozing. The wound is filled with blood-clot which we will not remove until we are ready to repair the injury. While this is civil surgery, we can apply some of the principles which the war has emphasized.

This patient comes to us during the period of contamination, and in civil practice we should see almost all our wounds much short of the arbitrary eight hours usually allowed before the beginning of the period of infection. We shall proceed, therefore, to cleanse thoroughly the skin surrounding the wound. For this purpose we shall use tincture of green soap and water, taking care not to slop the infected water into the wound. We shall now shave the entire adjacent area and cleanse again with soap and water, and then follow with 70 per cent. alcohol. Benzine followed by iodin is an excellent method where time is a factor, but where we have sufficient time at our disposal I prefer the mechanical cleansing with soap and water before attempting any method of sterilization. The blood-clot is now removed and I am swabbing out the wound surface with tincture of iodin. I find that there is a ragged wound extending deep into the gluteus maximus muscle, and it is from this wound that the bleeding is occurring. Fragments of overalls and dirt are ground into the muscle. The patient is thoroughly anes-

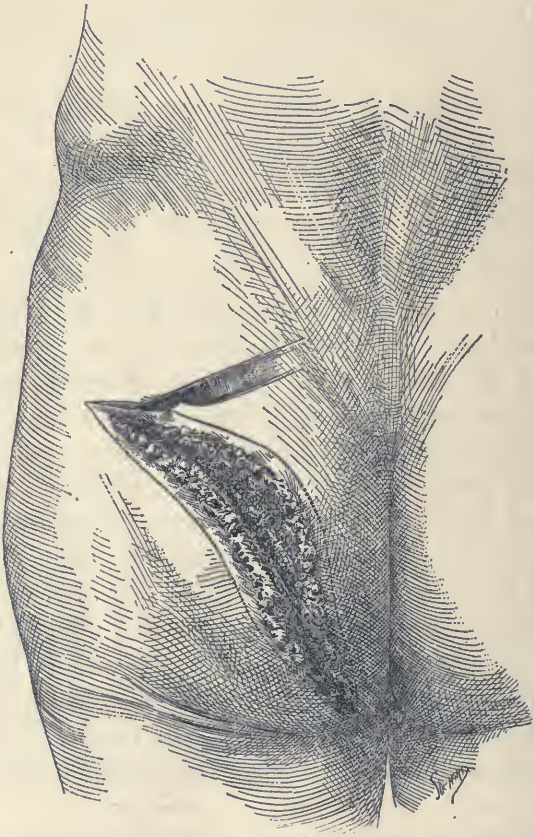

Fig. 508.—Debridement; incision at a distance from wound margins to insure removal of contaminated tissue without soiling operative wound.

thetized and I shall now proceed with debridement (Fig. 508). As the patient is rather fat there will be no difficulty in obtaining closure, and I will keep well away from the wound. I have now removed in one block all the torn muscle and about 2 cm. of skin on either side of the wound (Fig. 509, *a*). It is essential to obtain good hemostasis, as blood or serum will make a good culture-medium. The muscle is carefully closed by interrupted sutures of catgut, taking a good deal of care to obliterate all the dead space, and the skin and underlying fat sutured with interrupted silkworm-gut and silk stitches (Fig. 509, *b*). It is well to insert a small collapsible rubber drain at the lower end of the wound to take care of any further secretion. There is no reason why primary union should not be obtained, and this drain will probably be removed at the end of forty-eight hours.

There is nothing new about this method. The great lesson the war taught was that the earlier a case was operated upon after injury, the lower the mortality. Professor Depage, in his address before the American Surgical Society, stated that during the war by early operation the mortality in abdominal cases had been reduced from 65 to 45 per cent. He recommended in those cases in which there was a doubt about the wound remaining sterile that it be left open and handled by Dakin's solution, secondary suture being done on the second, third, or fourth day. Whether one should use Dakin's solution or not in this type of case is still a much debated question, but the underlying surgical principles are the same always. In a community such as this there is no reason why a man should not have the benefit of surgical care well within the period of contamination, and primary closure should be the rule. In case of suspected infection we must get efficient drainage whether we use Carrel-Dakin or not. I think that we can heartily agree with Major Bulkley who, in summing up his experience with fractures of the femur, said, "If more attention were paid to the operative treatment, less would be heard of the chemical treatment of wounds."

As a matter of routine this patient is given a prophylactic dose of 1500 units of tetanus antitoxin while he is still asleep. We have recently had a death from tetanus. The patient had

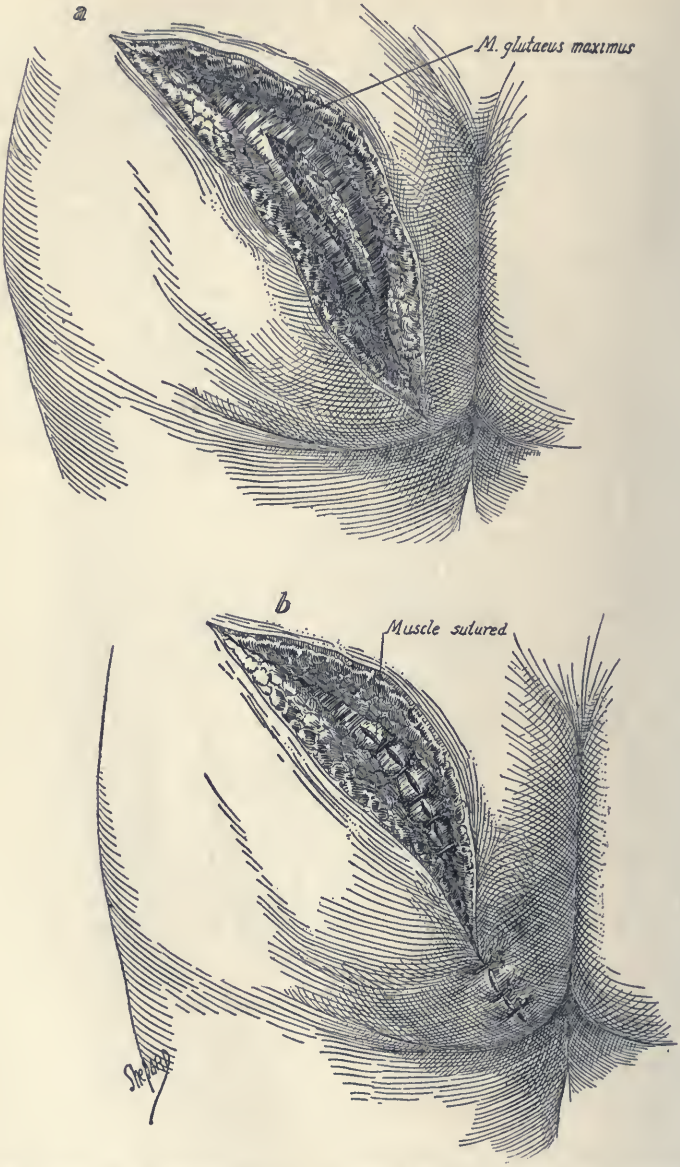

Fig. 509.—*a*, Debridement completed; wound ready for closure; *b*, closure of wound in layers by means of interrupted sutures, taking care to ensure complete coaptation of opposing raw surfaces.

been treated for five days at home for an injury of the hand. There was a bad infection of the hand and arm when she entered the hospital. No one thought of tetanus at this time, and no antitoxin was given. Three or four days later she developed trismus and two days later she died.

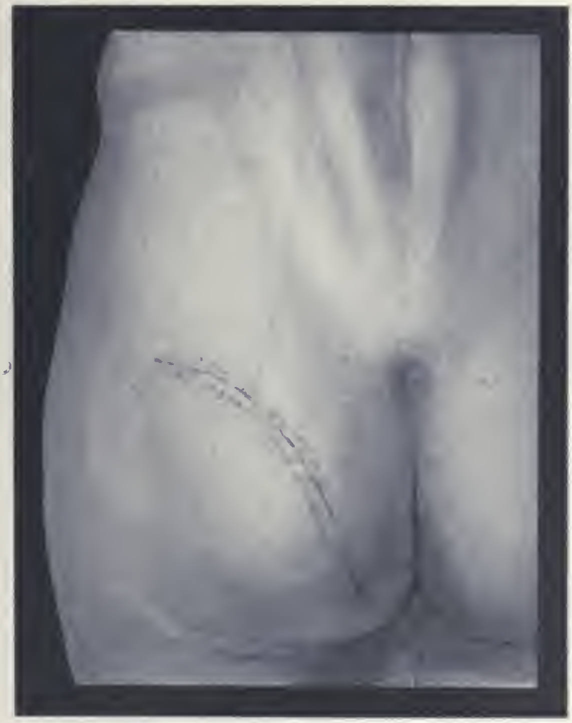

Fig. 510.—Healing by primary intention; appearance of wound at time of discharge from hospital ten days after operation.

After-history.—There was not the slightest drainage from the wound and the drain was removed at the end of thirty-six hours. The stitches were removed at the end of a week, and the patient left the hospital at the end of ten days entirely well (Fig. 510).

CLINIC OF DR. GOLDER McWHORTER

Presbyterian Hospital

OSTEOMYELITIS WITH VARIATION IN GROWTH OF THE FEMUR FOLLOWING SEPARATION OF THE DISTAL EPIPHYSIS

Summary: Presentation of patient; discussion of the results of injury to epiphyseal cartilage—the experiments of Bidder and of Haas; application of experimental results to conditions in case under discussion.

This patient came into the hospital complaining of a chronic discharging sinus on the outside of the right leg just above the knee. The patient is sixteen years of age. Three years ago, at the age of thirteen, he received a traumatic dislocation of the lower epiphysis of the femur. He was operated at that time in order to replace the epiphysis, which was held in position by means of a Lane plate. A sinus formed above the plate, and two months later the plate was removed. There has been a discharging sinus ever since. Otherwise his history is negative.

General Examination.—The patient is a well-nourished boy. Examination is negative except for his right lower extremity.

There is a small sinus on the lateral side of the thigh just over the condyle discharging pus. This leads down to a cavity in the lateral condyle of the femur.

The right leg appears shorter than the left, smaller, and there is a genu valgum deformity present. On measuring the length of the two legs from the anterior superior spine to the medial malleolus, the right is 1¼ inches shorter than the left. By measuring from the spine to the adductor tubercle the shortening is found to be in the femur.

The circumference of the right thigh, 10 inches below the anterior superior spine, is 1 inch less than that of the left. The circumference of the right knee is $1\frac{1}{4}$ inches greater than the normal left knee and that of the right calf is $\frac{3}{4}$ inch less than that of the left.

When the patient is standing we can see an interesting deformity due to the disturbance in growth of the epiphyseal cartilage. This disturbance has not only resulted in shortening, but in a more marked shortening on the outer side of the right femur which has produced a genu valgum (Fig. 511). The pelvis tips to the right with a compensatory scoliosis, due to the shorter right leg. When the knees are in contact the right foot is 4 inches from the left.

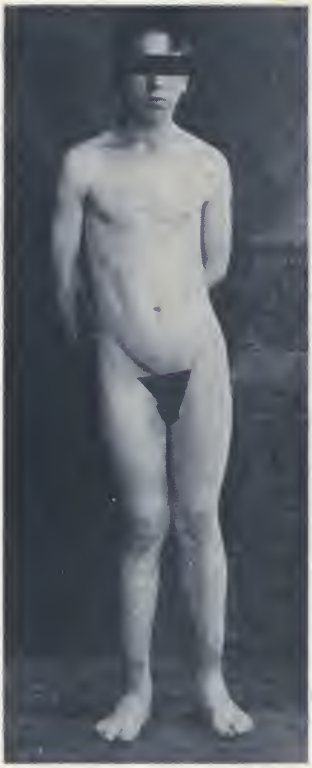

Fig. 511.—Note tilting of the pelvis and scoliosis due to the shorter right leg. The left leg is straight; genu valgum appears only in the right.

The roentgenogram gives evidence of a cavity in the metaphysis of the lateral condyle (Fig. 512). There is obliteration with ossification of the epiphyseal line on the lateral side (Fig. 513). There is some irregularity of the metaphysis (Fig. 514) probably due to a fracture at the time of the separation of the epiphysis.

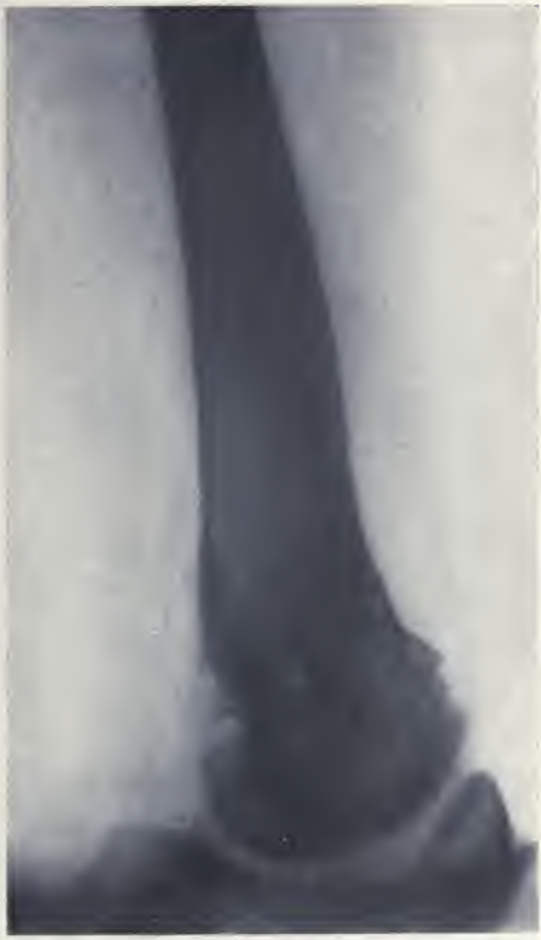

Fig. 512.—*x*-Ray photograph taken before operation; there is a cavity in the metaphysis of the femur.

I will describe briefly the operation for the cure of this osteomyelitis and the bottle-shaped cavity in the bone, and then discuss the very interesting disturbance of growth which we have.

Operation.—General anesthesia. The old scar is excised along the lateral side of the femur, keeping above the joint line. The thickened periosteum reflected laterally and a small opening which leads into a large cavity in the bone is exposed. This cavity contains granulation and scar tissue. The opening is enlarged with a chisel and enough of the sides removed so that the

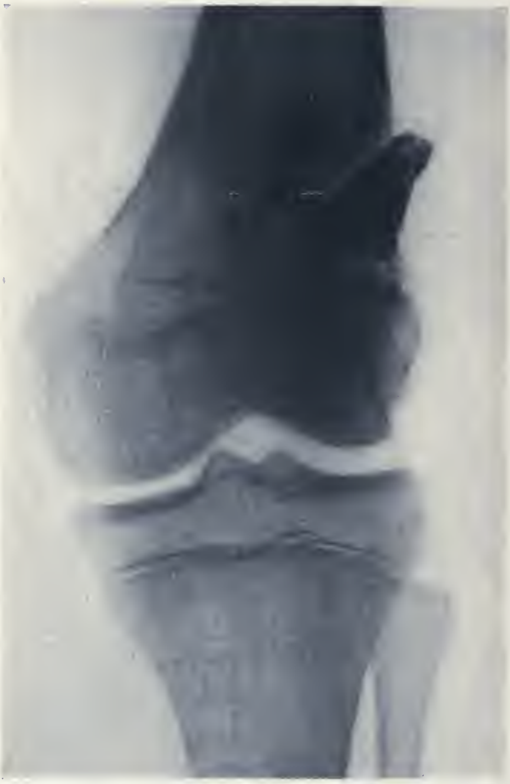

Fig. 513.—*x*-Ray photograph made two months after operation. This shows the obliteration of the epiphyseal line on the lateral side of the femur and the overgrowth on the medial side. The iodoform-wax filling is still in place.

cavity is slightly wedge shaped, with the base at the narrowest part. The entire inner surface is chiseled and cureted. Hemorrhage is controlled and sterilization attempted by application of 95 per cent. phenol, followed by alcohol. There are still a couple of oozing areas in the bone that I am controlling by means of Horsley's bone-wax.

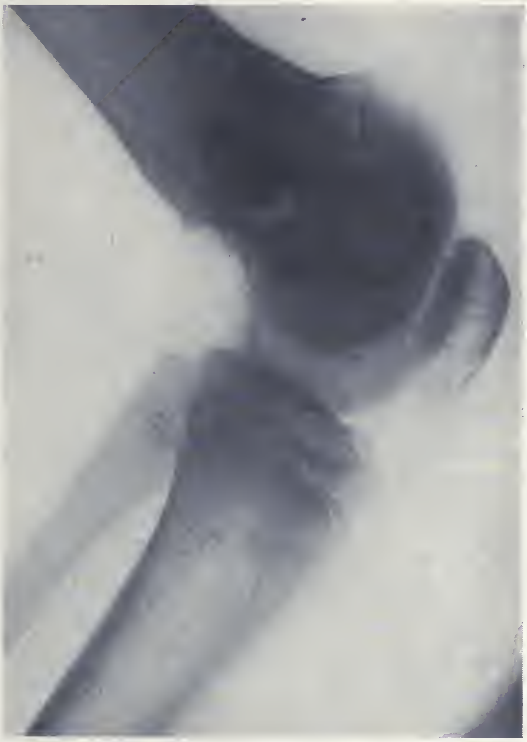

Fig. 514.—*x*-Ray photograph made two months after operation; lateral view. There is marked irregularity of the metaphysis.

I am filling the space in the bone with Mosetig-Moorhof's iodoform-wax filling. This has been melted and cooled down to the consistency of butter. The soft parts are sutured with interrupted silkworm-gut stitches without drainage.

This may heal up by primary union, but probably there will be some discharge of the iodoform wax. The use of the wax makes it unnecessary to keep the cavity packed with gauze, eliminates frequent dressings, and may result in primary healing. The heel of his right shoe will be raised and that of his left lowered to partially compensate for the shortening of his leg.

In contrast to this case I want to discuss a case I had in the clinic about a year ago. This patient was a male about forty-five years of age. He came in complaining of symptoms resembling a sacro-iliac strain. I examined him carefully and found the right leg to be 1¼ inches longer than the left. This was due to an increased length of the tibia. There was some enlargement and thickening of the tibia, but no lateral deformity.

He stated that at about twelve years of age he had had a severe bone abscess, which involved the tibia and had broken by itself and finally healed. He did not know of the increased length of this leg and had only developed symptoms within the last two or three months. The osteomyelitis had evidently stimulated the upper epiphyseal cartilage plate of the tibia to increased activity.

Discussion.—Bidder in 1872 performed a series of experiments upon animals to determine the influence of injuries to the epiphyseal cartilage plate upon the development of the bone. He injured the epiphyseal cartilage plate by means of needles stuck into and by cutting through into that region. When he injured the outer side of the epiphyseal cartilage the outer side of the bone remained shorter than the inner, and the reverse was also true. If the whole cartilage was injured there was an even hindrance of longitudinal growth. The plate became degenerated and was replaced by connective-tissue cells or bone trabeculæ which connected the diaphysis and epiphysis.

There were more changes in the experiments where there was osteomyelitis present in addition to injury to the epiphyseal cartilage plate. Bidder concluded that where physiologic activity was changed by stimulation or destruction there entered a disturbance of longitudinal development with characteristic deformity. He believed that length depended upon the integrity of the epiphyseal cartilage; when the cartilage became the site of inflammation or necrosis, synostosis of the bone segments might result.

Ollier made the following conclusions:

"1. Insignificant incisions into the epiphyseal cartilage plate are without influence upon longitudinal growth.

"2. Marked lesions or excisions have a strong influence and cause shortening or collapse.

"3. Separation of the epiphysis is without influence if it is immediately replaced in good position.

"4. Full excision of the epiphyseal cartilage plate causes complete cessation of growth."

Haab found that sticking pegs into the diaphysis caused a stimulation of growth because of the indirect stimulation of the epiphysis. When the epiphysis was so treated there was a resulting shortening.

Meisenbach found, after experimentally stimulating the cartilage cells, in some cases a wide epiphyseal line and increased compactness of diaphyseal bone. He found that a stimulated epiphyseal line may be replaced by new bone. He describes the epiphyseal cartilage plate as composed of: (1) columnar cells of cartilage; (2) proliferating cartilage cells (swollen cells of the diaphyseal line); (3) zone of calcified matrix.

Haas states that the epiphysis separates from the metaphysis uniformly in the region of the large vesicular cells of the columns of cartilage.

Haas has recently performed some interesting and very conclusive experiments with relation to the longitudinal growth of bone after injury to the epiphyseal cartilage plate, and also upon the value of the blood-supply in the region of the plate. From his experiments he concluded that an adequate blood-supply directly to the epiphysis is necessary for proper growth. He found that when the blood-vessels in the region of the plate are destroyed the loss of growth was greater than with destruction of the nutrient artery. The loss of growth was in proportion to the injury to the blood-supply. Other factors, of course, may enter, such as disturbances of the endocrine system, or stimulation or injury of this region by trauma or disease.

Some of the experiments that Haas performed upon growing bones are very interesting, and I will give the general results in abstract. He used chiefly the growing metacarpal or metatarsal bones of dogs.

Group I. Simple cross incisions through the epiphysis:

1. A simple incision made through the epiphysis distal to the epiphyseal cartilage plate. There resulted slight or no disturbance in growth.

2. An incision through the epiphyseal cartilage plate. (*a*) Direct incision through the cartilage without separating the surrounding tissues. There resulted early ossification of the plate by changes in its center. The greater injury made a proportionally greater disturbance in growth.

(*b*) Incision through the periosteum with separation in the line of cleavage. There always resulted a disturbance in growth. Haas thinks it possible to make a separation without causing loss of growth. There resulted about the same disturbance by incising through the cartilage as from a separation in the line of cleavage.

3. Incision through the metaphyseal region across the bone. This healed as a fracture in the shaft without causing any disturbance in length.

Group II. Longitudinal incisions through the epiphyseal cartilage plate:

1. Following a longitudinal incision through the epiphysis into the diaphysis there was no disturbance.

2. Following a longitudinal incision through the entire bone there was a definite disturbance. The author thinks this due to a greater disturbance of blood-supply.

Group III. Cross incision and raising and reimplanting the distal fragment:

1. No disturbance when the incision was distal to the epiphyseal cartilage plate.

2. Always a marked loss of growth resulted when the incision was made through the cartilage plate, but never complete cessation.

3. When the cross incision was made through the metaphysis there was complete cessation of growth in nearly every case.

Group IV. Longitudinal incisions with removal of one-half of section:

1. Where the incision extended from one end through the epiphysis up to the metaphysis, there was only a very small amount of growth after the operation.

2. Where the incision included the metaphysis the result was about the same as with previous experiment.

3. Following the incision through the entire bone and removal of a longitudinal one-half of bone there was practically complete cessation of growth.

Group V. Cross incision with removal of distal fragments:

1. Following an incision across the epiphysis distal to the cartilage plate there was no disturbance.

2. After the removal of the entire epiphysis up to the metaphysis there was almost complete failure of longitudinal growth.

3. After removal of the metaphysis and epiphysis there was a pointed outgrowth from the diaphysis, but less growth than normal.

Group VI. Cross incision with removal of the proximal segment:

1. After an incision through the line of cleavage of the epiphyseal cartilage plate the segment was removed, leaving the epiphysis with the cartilage plate. There was practically complete cessation of growth.

2. After an incision through the metaphysis and removal of the segment there resulted some growth, but near the cartilage plate there was always considerable hindrance.

Group VII. Boring into and removing the cancellous bone of the epiphysis:

1. There was no hindrance of growth following boring directly into the epiphysis.

2. Following boring into the epiphysis through the epiphyseal cartilage plate there was decided hindrance of growth.

Group VIII. 1. After crushing the epiphyseal cartilage plate and adjacent bone by a forceps there was early ossification, with loss of growth in proportion to the injury.

2. After cutting out a wedge from the region of the epiphyseal cartilage plate there was cessation of growth and ossification. (Only a few experiments of this type were performed.)

In the localization of the growing point on the epiphyseal cartilage plate Haas concluded from his experiments that the metaphyseal region plays little rôle in growth, but acts only as a medium for growth, but is also concerned in the ossification of the cartilage. He believes that growth is due largely to the cartilage columns and adjacent cells in the epiphyseal cartilage plate.

Haas studied the relation of the blood-supply to the longitudinal growth of bone. He found that the chief blood-supply to the epiphyseal line of the metatarsals comes from the plantar arteries. These arteries after reaching the epiphyseal line encircle the bone, into which they send penetrating branches and anastomose with vessels on the dorsum. The nutrient artery also enters on the plantar surface near the base of the bone.

Haas found that there is practically no disturbance in growth after cutting the tissue and blood-supply of the basal part of the bone, but it is marked after destruction of the epiphyseal blood-supply. If both the nutrient artery and the epiphyseal arteries are injured there is a greater loss of growth than when only the ones to the epiphysis are injured. Apparently the nutrient artery blood-supply is not so important a factor in length producing as is the epiphyseal blood-supply.

These facts should be borne in mind when operating in the region of the growing epiphysis. Disturbances may follow injury of the soft parts including the blood-supply to the epiphysis either by the original trauma or through operative interference, without direct injury to the epiphyseal cartilage plate.

Clinically we may see complete or partial arrest in bone growth after fractures in the region of the epiphyseal line, through the epiphysis or metaphysis, often associated perhaps with some separation. There may be increased growth near a diseased focus—tuberculosis and other forms of infectious processes

(Meisenbach, MacAusland), apparently a result of the stimulating effect of adjacent inflammation.

Hentschel reports a case of lateral bending in the tibia and fibula after acute osteomyelitis.

Elmslie believes that a not infrequent talipes varus deformity may be due to the partial arrest of growth of the lower end of the tibia due to a longitudinal fracture through the narrowest part of the epiphysis accompanied by a partial separation of the inner part of the epiphysis. This results in a scar across the new bone at the extremity of the diaphysis on its inner half with a resulting diminution or cessation of growth. The outer part may continue its growth resulting in a varus deformity in this type of fracture and separation.

Sir Robert Jones states that he has had many instances of separation of the epiphysis due to surgical operations in their vicinity without a subsequent difference in growth.

There may have been a combination of several reasons for the disturbance of growth in this case. We know there must be complete cessation of growth on the outer side of the femur, as there is obliteration of the epiphyseal line and fusion of the epiphysis to the diaphysis. It is possible that some growth may have occurred before this took place. There is marked loss of growth on the medial side, but it has not stopped growing with the other side, as evidenced by the genu valgum. Since the epiphyseal line is still present on the medial side there is little doubt that the deformity will increase. The loss of growth is evidenced by the shortening and the deformity. There is some broadening of the femur in the epiphyseal region, as this is greater in circumference than the left one.

The cause of the disturbance in growth may have been any one or a combination of the following:

1. Injury to the blood-supply to the epiphyseal line or injury to the surrounding soft parts at the time of the accident or of the operation.

2. Injury to the epiphyseal cartilage plate at either time.

3. Extensive fracture or crushing of the metaphysis with or without direct injury to the epiphyseal cartilage plate.

4. Inflammation of the bone directly or indirectly traumatizing the growing columns of cartilage and causing early ossification.

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CLINIC OF DR. BENJAMIN F. DAVIS

Presbyterian Hospital

FRACTURE-DISLOCATION OF THE ASTRAGALUS

Summary: Late result of astragalectomy; diagnosis of fracture-dislocation of astragalus; treatment—astragalectomy inadvisable as a rule; mechanism of fracture-dislocation.

In a previous clinic we studied a case of fracture of both calcanei in which practically all the various causes of post-traumatic disability occurring in such cases were demonstrable, and we were given an opportunity to consider the best methods of managing fracture of the calcaneus with an eye to the removal of these causes of disability and the consequent restoration of the patient to an active life (Surgical Clinics of Chicago, October, 1919). Today we are fortunate in having another case of trauma of the tarsal bones to consider in comparison with the case we have already studied.

The case is that of this young man who is now about thirty-three years of age. As you see him walk across the floor you observe that he limps slightly, favoring the right foot, and that there is a tendency for him to hold that foot in slight inversion and outward rotation (Fig. 515). We remove the shoe and stocking and find that the normal arch of the dorsum of the foot has disappeared, the dorsum is almost flat from before backward, and the angle between it and the anterior surface of the tibia is but slightly greater than a right angle (Fig. 516). The heel projects; the malleoli are much lower than on the opposite foot; there is inversion, a tendency to walk on the outer border of the foot (Fig. 517), and the foot and leg are carried in outward rotation, so that instead of the natural springy heel-and-toe gait of the normal foot, the patient stumps along rolling his weight diagonally from the outer side of the foot when it is placed on the ground to the inner side when the foot is raised. A limited degree of motion is possible in all directions; there are no points of tenderness, although the patient complains of slight general soreness about the middle of the foot after a day's work. There is a well-healed operative scar about 4 inches in length curving from the leg on to the foot behind the internal malleolus. It is evident that something is missing from the tarsus of this foot; the calcaneus is obviously present; the astragalus, then, must be the missing factor, as it is the only bone whose isolated absence would permit the malleoli so nearly to approach the sole of the foot; it also is largely responsible for the convexity of the dorsum of the foot at the ankle-joint in the normal foot which is absent here. This is a case of fracture-dislocation of the astragalus with comminuted fracture of the internal malleolus, treated by astragalectomy.

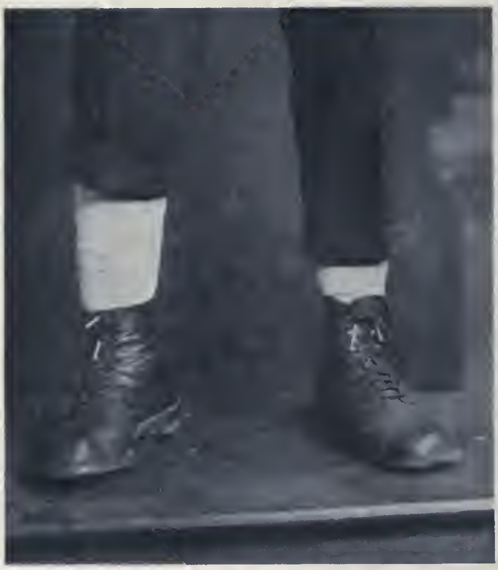

Fig. 515.—Patient standing with full weight on both feet. Note the inversion and outward rotation of the right foot.

The patient first entered this hospital on a stretcher from a police ambulance about fourteen months ago. About two hours before, while he was driving a motorcycle and side-car at the usual reckless speed with which such vehicles are driven, he was side-swiped by a motor truck; our patient was pulled from under the wreck. He was carried to a nearby drug-store, where a doctor tried unsuccessfully to reduce a so-called dislocation of the ankle, and thence, as stated, to this hospital.

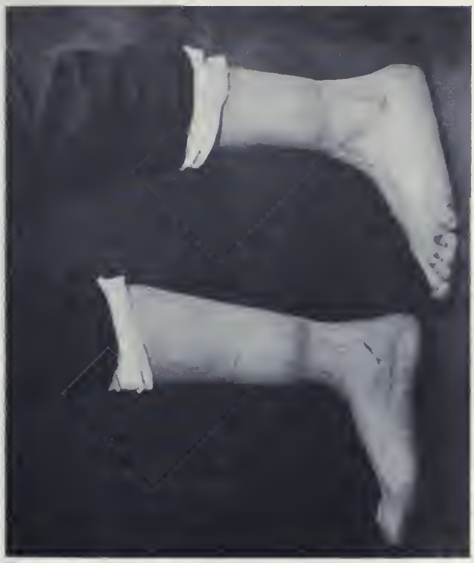

Fig. 516.

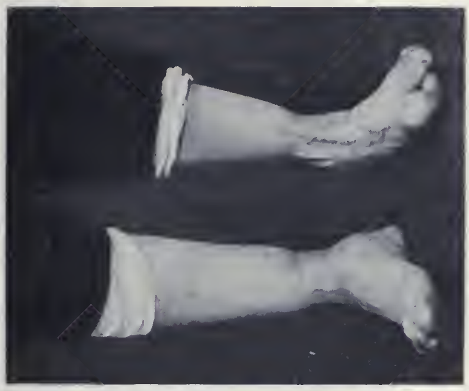

Fig. 517.

Figs. 516, 517.—Patient standing with full weight on both feet. Note that the right foot is inverted, the dorsum is flattened, and the internal malleolus is but half as far from the floor as the corresponding malleolus of the opposite ankle.

I saw him on the following morning. He presented numerous cuts and bruises about the head and shoulders, a fracture of the right carpal navicular, a huge abrasion of the left thigh and knee, and the lesion of the right foot, which I have already mentioned. The skin about the ankle was the site of the most extreme ecchymoses; there were several blebs, the largest lying

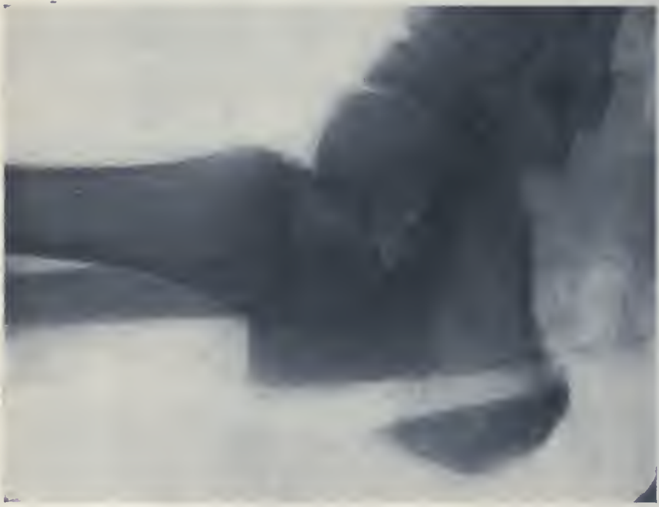

Fig. 518.

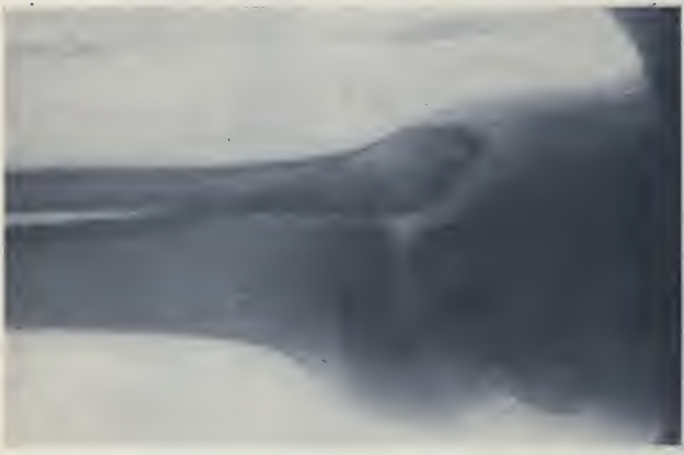

Fig. 519.

Figs. 518, 519.—*x*-Ray photographs of fracture-dislocation of the astragalus with complete posterior and medial displacement of the body of the bone.

over a bulging of bone-like hardness behind the internal malleolus. Motion of the foot was impossible and pain was marked. The skin over the abnormal bulging seemed to be on the verge of dissolution. x-Ray plates disclosed fracture through the neck of the astragalus with complete luxation of the body of the bone backward and inward and comminuted fracture of the tip of the internal malleolus (Figs. 518, 519).

Under ether anesthesia an attempt was made to reduce the dislocated fragment; this being unsuccessful, open operation was resorted to. With the fragment fully exposed we were unable to force it into position, and the seminecrotic condition of the overlying skin and fat tissue did not seem to warrant our carrying our incision through adjacent tendons in order to permit sufficient separation of the tarsus and tibia for reduction. The entire astragalus was therefore removed.

Formerly astragalectomy was regarded as the correct procedure in cases of dislocation of the astragalus, since reduction without open operation is difficult—although sometimes possible when combined with tenotomy of the tendo achillis or other resisting structures—and open operation was considered a grave risk. Later, astragalectomy was reserved by most men for cases of compound dislocation, as it became evident that reduction could be made easily if the incisions were radical enough, and that even though the fragment of astragalus were completely detached, it was capable of living if restored to its normal position. Lately even compound injuries have ceased to be regarded as demanding astragalectomy. In such instances we are advised to irrigate the wound thoroughly with a gallon or two of warm normal salt or a weak hydrogen peroxid solution, remove all foreign matter, excise devitalized tissue, and, after reducing the dislocation, make a primary closure of the wound; if necessary in order to obtain closure it is permissible to slide skin-flaps from neighboring areas, even leaving such areas raw rather than fail to cover the site of the dislocation (Preston, Fractures and Dislocations: Diagnosis and Treatment, St. Louis, 1915, p. 692). If suppuration ensues, drainage is required.

The degree of disability following astragalectomy in these traumatic cases is quite variable. The patient before us represents an average case. He limps noticeably, yet he is working full time as a mechanic in a wagon repair shop and experiences little difficulty.

The mechanism of the production of fracture-dislocation of the astragalus is interesting. Apparently the displaced fragment is projected from its bed just as one may cause a pea to be expressed from the pod; this may occur as the result of combined extension and torsion of the foot, in which circumstance the dislocation will be anterior, or in excessive dorsal flexion with or without torsion (Stealy, Surgery, Gynecology, and Obstetrics, vol. 8, p. 36, January, 1909). The usual cause of dislocation is a fall from a height. It is stated that the higher the fall, the lower the fracture. In falls from a considerable height the os calcis is likely to be the bone fractured; in falls from lesser heights, the astragalus; in still shorter falls, the bones of the leg (Brooke, Medicine and Surgery, vol. 2, p. 530, May, 1918).

Fractures are usually of the neck or body of the bone. They may be simple fissure fractures or may be characterized by marked comminution; they are sometimes, of course, compound. In those involving the neck there is generally marked displacement and rotation of fragments, especially of the anterior one. When the anterior fragment is displaced, reduction is often accomplished by manipulation and the end-result is fairly good from the functional standpoint. When the posterior fragment, that is, the body of the bone, is displaced backward, the functional result generally is poor unless an open operation is resorted to and the dislocated fragment forced into its normal position.

The following is a summary of Brooke's observations on this subject: Fracture of the astragalus is more frequent than is commonly supposed. When fracture occurs without displacement, immobilization is all that is required and the end-result is usually normal function. When there is marked separation or rotation of fragments, although reduction may be accomplished, especially with the aid of achillotomy, open operation will usually be required. After reduction it is unwise to permit full weight bearing in less than four months. In old fractures, with deformity, astragalectomy usually gives the best results.

The patient before us wore a cast for ten weeks, walking in the cast during the last two weeks of that period. We then applied a Gibney dressing, which was worn for several months. He has now been working full time for about six months and wears no support other than his shoe.

CLINIC OF DR. WILLIAM THOMAS HARSHA

Illinois Central Hospital

ACROMEGALY

Summary: Diagnosis of acromegaly; current speculations concerning etiology; treatment of little value.

This man is American born. He is fifty years old, married, and a steamfitter by occupation. The history is as follows:

Complaint.—(*a*) Headaches; (*b*) frequency of urination.

Onset and Course.—The headaches have been present for about one year; they occur at any period of day, *i. e.*, day or night. There is no special localization—may be either frontal or basal, or both. There has been no preceding aura, no gastro-intestinal disturbance accompanying headache, no change in vision, no muscular weakness. Appetite is good and bowels are regular.

Urination.—Frequency seems to accompany headaches, at which time he has to urinate two or three times a night.

Previous Illness.—Childhood diseases. No illness remembered during adult life.

Family.—Father died at seventy-six; mother living. Four brothers and four sisters living and well. No history of tuberculosis, carcinoma, or nervous disorder in family.

Sexual.—Gonorrhea twenty-six years ago. Denies luetic infection.

Habits.—Used alcoholic beverages freely until eight months ago. Smokes cigarettes occasionally. Eats and sleeps regularly.

Marital.—Married twenty-five years. No children living; one still-birth; one died at one year; another at two years; wife had two miscarriages.

Physical Examination.—The patient is a fairly well built and nourished male, not acutely ill.

Head and Neck.—The face is lengthened, the lower jaw protruding beyond the upper; the nose is enlarged and the lips thickened. No adenopathy or enlargement of neck. Thyroid normal (Figs. 520, 521).

Eyes.—React to light and accommodation.

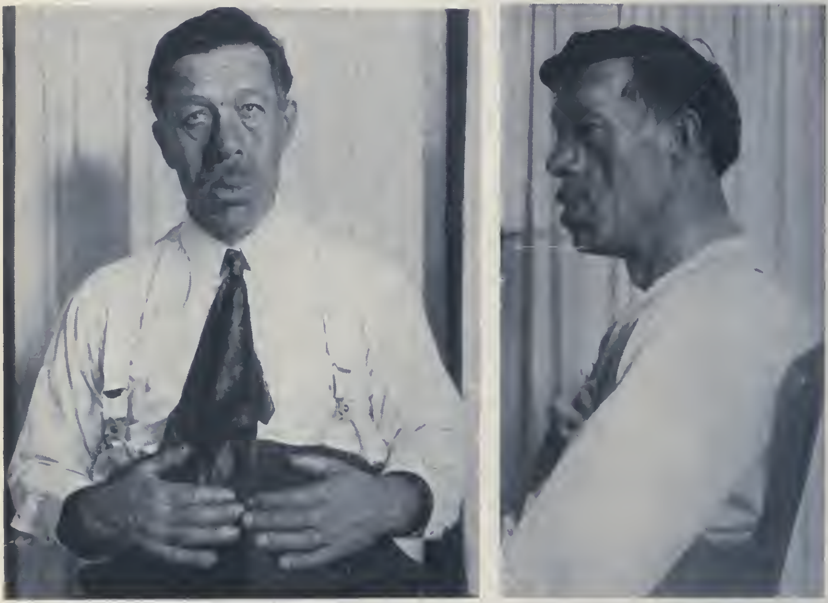

Fig. 520. Fig. 521.

Figs. 520, 521.—Photographs of patient described in the text showing acromegalic changes in hands and face.

Ears.—Not unusually large.

Mouth.—Teeth are in very poor condition, carious. The roof of the mouth is very highly arched and forms an acute angle. The alveolar margin of the upper maxilla is markedly hypertrophied.

Chest.—Symmetric; expansion limited, but equal on both sides.

Lungs.—No dulness or râles.

Heart.—Borders normal; tones clear; no murmurs.

Abdomen.—Liver and spleen not palpable; no tenderness; no tumor masses.

Extremities.—Upper: There is marked thickening of the fingers and clubbing of the distal phalanges. Lower: There are no marked changes. The toes appear of normal proportions.

Reflexes.—Abdominal, cremasteric, patellar, and plantar are lively; no Babinski; no ankle-clonus.

There is thickening and hypertrophy of the bones, especially about the chest. The clavicles, ribs, and sternum are larger than normal. Other bones which are hypertrophic are the maxillæ and the bones of the hands.

The arteries, which are palpable, are moderately sclerosed. The pulse is strong, regular, and equal on both sides.

Blood-pressure is 190 systolic and 126 diastolic; pulse pressure, 64.

No change shown in the testes and function is normal.

Examination of the eyes February 2, 1919, was reported by Dr. Lane as follows:

Right vision—20/25ths, plus 2.

Left vision—20/20ths, minus 1.

No pathologic findings (normal disks).

Examination of gastro-intestinal contents revealed no striking abnormality.

The urine contains a trace of albumin and a few granular casts. The average quantity secreted in twenty-four hours is about 2200 c.c.

Blood examination is negative for pathologic changes.

x-Ray examination made of the sella turcica was reported as follows:

"Anterior and posterior clinoid processes elongated, so they meet and completely enclose the sella, otherwise normal (Fig. 522)."

Such a deformity of the sella has not been proved to be of clinical importance.

In the case of the vertebræ, feet, knee, and shoulder the reports were as follows:

"Marked proliferative changes and spur formations, involving all lumbar vertebræ, bones forming the shoulder and knee-joints (Fig. 523) and distal phalanges of both feet (Fig. 524)."

On the basis of the preceding clinical examination we have made the diagnosis of acromegaly and chronic interstitial nephritis.

Fig. 522.—*x*-Ray photograph of skull of patient with acromegaly. The sella is not enlarged in this case. Note the exaggeration of the normal bony prominences, particularly the marked lengthening of the lower jaw.

The bony overgrowth of acromegaly has always received a great deal of interest. The function of causing the overgrowth is usually attributed to the hypophysis, and often, associated with acromegaly, an increase of chromophile cells is seen in the anterior lobe. Adenomata, rich in chromophile cells, cysts, and other tumors of the hypophysis are also often present in cases of acromegaly.

The theory is that there are separate types of functionating

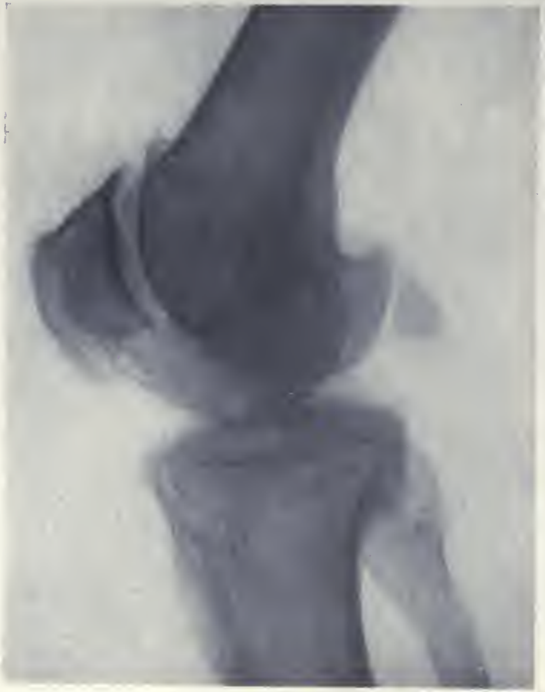

Fig. 523.

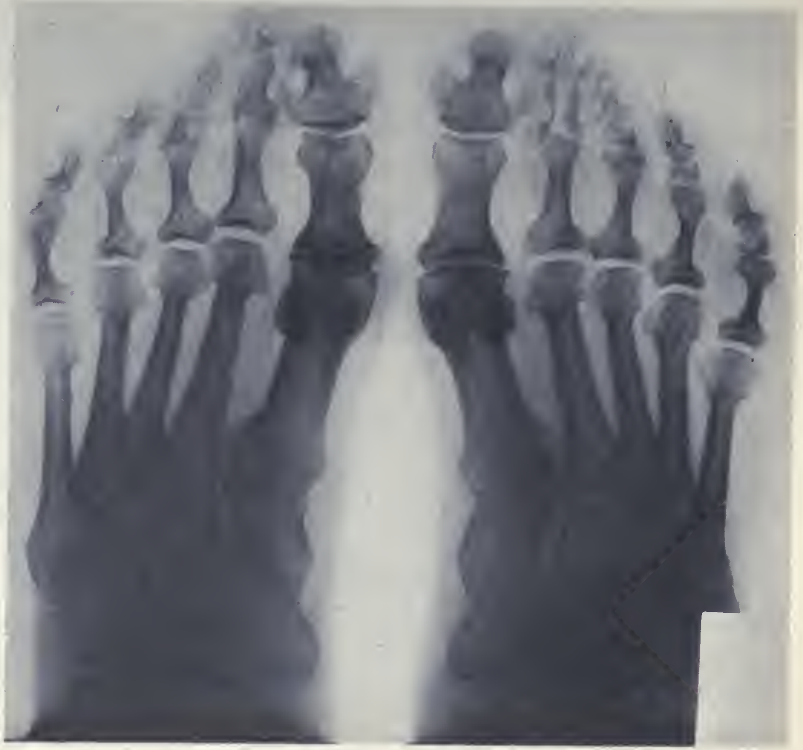

Fig. 524.

Figs. 523, 524.—Hyperostosis and arthritic changes, those in Fig. 523 strongly resembling the changes found in hypertrophic osteoarthritis.

cells within the anterior lobe of the hypophysis, and that a predominance of one cell type determines acromegalic characteristics. Recent histologic studies give some support to such a theory of pathogenesis.[1]

Edward Uhlenhuth,[2] in discussing metamorphosis in amphibian larvæ, suggests the presence of special chemical mechanisms as necessary to the development of the different characteristics.

According to Uhlenhuth, "Development of the skin coloration, as well as development of the legs, sex organs, tongue, and palatal teeth, are all caused by substances not identical with the substance causing metamorphosis, and since they are also all independent of each other in their development, it is probable that a special chemical mechanism exists for the development of each one of these six groups of organs. The noteworthy fact of the amphibian metamorphosis is that instead of being controlled and kept in harmony by the organic individual, the development of at least six groups of organs is controlled separately by the action of probably six different chemical mechanisms, each of which can be stopped or enforced independently of each other, by directly supplying the substance required, or by causing an increased formation of it within the body by suitable temperatures."

In accordance with this idea acromegaly may be an expression of the unbalanced chemical mechanism resulting from changes in the activity of the hypophysis.

The interrelationship of pituitary and thyroid has been often suggested.[3] Allen[4] has shown that tadpoles from which the thyroid and pituitary have been removed show progress toward normal metamorphosis upon being fed iodin, and Hoskins has shown that thyroidectomy prevents metamorphosis in amphibia at least for two seasons, one and one-third years, if the animals are kept on a normal diet. A chemical mechanism similar to that postulated to exist in acromegaly has been shown to exist in a plant organism by Jacques Loeb.[5]

That bone changes of the kind shown in this case are not new to animal life is shown by the presence of such changes in fossil fishes and reptiles, and it has been suggested that the results of the study of such material may even afford support to the present theory of the pathogenesis of such lesions.[6]

The interesting feature in our case is the presence of the hypertrophic changes which are often associated with infective processes in the individual, and also the presence of the physical characteristics of acromegaly.

The changes seen in the plates are most marked in the hands, feet, and lower jaw. Hypertrophic changes, exostosis formation, and spurs are also shown in the vertebræ, femora, ilii, and cranium. The mandible shows considerable overdevelopment, giving the profile marked prognathism (Fig. 522). The cast made of the mouth shows overdevelopment of the alveolar arches and a high palatal arch. The skull shows increase in the occipital and glabellar prominence. The sella turcica is apparently normal. No increase in the size of the pituitary fossa is shown by the plate.

It is of interest that the bony overgrowth is more marked at the tip of the extremities than elsewhere. The distal phalanges of the hands and feet show the most marked hyperostosis. The exostoses spring from the cortex and its periosteum, and no ingrowth into the medullary cavities of the bones is seen. The cortex-medullary relation is normal. The hyperostoses are apparently accentuations of the normal roughenings and tuberosities of the bones.

The similarity of the changes seen in the bones to those which are usually associated with chronic hypertrophic osteoarthritis is an interesting feature of the case.

There is, of course, no effective treatment. Occasionally it may be desirable to operate in the presence of tumors which compress the optic nerve and thus destroy vision. In such cases operation should be done early if it is to be of greatest value; operation is useless after the patient has become blind.

Experimental work has determined some of the effects of gland extirpation,[7] [8] deposition of fat, sex atrophy, and failure to develop secondary sex characteristics resulting from the removal. The effect, however, of increase in function of the hypophysis has not been definitely determined and the relation of bone changes to pituitary function is yet debatable.

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CLINIC OF DR. THOMAS J. WATKINS

St. Luke's Hospital

AMENORRHEA AND STERILITY DUE TO FUNCTIONAL ENDOCRINE DISTURBANCES

Summary: A patient with functional disturbances suggestive of loss of balance of the glands of internal secretion; recovery following administration of corpus luteum and thyroid extract.

Mrs. F. K. K., aged thirty-one, consulted me December 18 1916.

History.—Married eight and a half years; weight 156 pounds, a gain of 30 pounds in one year. Family history was good. She had always enjoyed comparatively good health.

Present Illness.—Illness consists in irregular menstruations, with periods of amenorrhea, rapid increase in weight, sterility, and extensive and abundant growth of hair over various parts of the body.

Puberty occurred at thirteen. She was fairly regular for ten years. There is no history of infection of either the patient or her husband.

The growth of hair on the abdomen is of the male type.

Abdominal and vaginal examinations revealed no pathology. The uterus and ovaries were easily palpable and apparently well developed.

Diagnosis.—The diagnosis was disturbance of function of some of the ductless glands.

Treatment.—The cervix was dilated and she was given 5-grain capsules of corpus luteum three times daily. Free menstrual discharge occurred after taking five of the capsules.

January 27, 1917, she reported having had three menstrual periods in one month. The corpus luteum was stopped and directed to be taken when needed to relieve amenorrhea.

March 30, 1917, Dr. Edward Reynolds, of Boston, to whom she was referred, reported an enlarged left ovary, probably a corpus luteum cyst, which he thought resulted from the use of corpus luteum.

On June 5, 1917, reported that she had a normal menstruation in April which lasted two weeks. No menstruation since then. That was the only menstruation since January, 1917.

June 20th reported that a normal menstruation followed dilatation of the cervix and the use of corpus luteum tablets. From this time she was directed to take corpus luteum tablets at the time of each approaching menstrual period, and to take a small amount of thyroid tablets during the intermenstrual period.

On September 26, 1918, she reported that menstruation had occurred each month. The enlarged left ovary had become normal in size.

April 29, 1919: Has not menstruated for five months. Examination shows a pregnancy of about five months' duration.

August 27, 1919: Patient gave birth to a child two weeks ago.

This detailed history is given as it is of interest to show the effect on menstruation from the use of corpus luteum and from dilatation of the cervix. The thyroid tablets were probably also of some service.

REMARKS

Although it is not possible to draw any conclusions from one case, there were a number of conditions present in this patient that are of much interest. The menstrual periods could be produced regularly by treatment. They would stop when the treatment was suspended. At times it was impossible to bring on menstruations by corpus lutuem and thyroid except in conjunction with dilatation. The relation of corpus luteum and thyroid to menstruation is so generally recognized as to need no special comment here. The probable effect of dilatation of the cervix was that it stimulated activity in the uterus.

She has lost in weight and the rapid increase in the growth of hair has stopped. There was little increase in the amount of hair after the glandular treatment was instituted. The fact that she was sterile for eight and a half years and that there had never been any pelvic infection suggests that the pregnancy was made possible by the treatment.

The patient had peculiar periodic sensations in the head which were attributed to disturbances of the hypophysis. There was a feeling of much fulness in the head when menstruation did not appear, which was relieved by menstruation. The obesity and excessive development of hair are generally considered to be due to disturbance of the hypophysis. Studies of tumors of the hypophysis have proved that there is a rather close functional relation between the hypophysis and corpus luteum. Menstrual disturbances are of importance in the diagnosis of tumors of the hypophysis. Menstrual disturbances of puberty seem to be closely related to the enlarged thyroid which is common at that age. The tendency for the thyroid gland to enlarge during pregnancy also suggests that the corpus luteum and the thyroid are functionally associated.

CLINIC OF DR. EDWARD LOUIS MOORHEAD

MERCY HOSPITAL

MULTIPLE UTERINE FIBROIDS: SECONDARY ANEMIA, NEPHRITIS

Summary: A patient with severe secondary anemia and chronic nephritis who presents a large uterine tumor; plan of treatment adopted—results.

MRS. B., aged forty-eight years, American, married. We have asked this patient to return this morning that you may see the results in a case in which the prognosis at the time of entrance to the hospital was not very good.

There is nothing unusual in her early history; no special illness that she remembers except measles and the minor diseases of childhood. Menstruation began at fourteen years; has always been regular and not attended by any special pain or discomfort. Her appetite has always been good; bowels regular; no headaches. Weight has remained about the same (160 pounds) for several years previous to her present complaint. She was married when twenty-five years of age and has one child who is twenty-one years old. There is no history of any miscarriage and she does not know of any reason why conception did not occur again. At the time of the birth of her child, twenty-one years ago, her husband says the physician in attendance stated "that there was a small lump or tumor near the womb." No further attention was paid to this, and the husband did not inform the patient of what the physician had stated.

Five years ago, while visiting one of the health resorts (Hot Springs), the physician in attendance there informed her that she had albumin in the urine. Nothing was done for this she states, except that she drank the water at the Springs for the time being.

Six months previous to her admission to the hospital she had a profuse uterine hemorrhage, occurring between the regular menstrual periods, but she attributed it to "*the change of life*," as she says her friends told her that was a common occurrence. Two months previous to her admission to the hospital there was another hemorrhage more profuse than the previous one, and a physician was called. He gave her some medicine to take, and after remaining quiet in bed for a few days the hemorrhage ceased. The physician who attended her at this time made no examination to ascertain the cause of the hemorrhage, but allowed the patient to remain under the impression that it was not unusual and was probably due to the menopause.

Following this last hemorrhage the patient was very weak. She could not stand any exertion. There was difficulty in breathing. Upon the slightest exertion respiration became labored and irregular. Her color was very pale and there had been some loss of weight.

Nine weeks ago the patient was admitted to this hospital. Her condition at that time was very bad. She was very pale, waxy in color. The respiratory movements were irregular and labored at times. A few râles were heard over both lungs. Cardiac dulness increased; apex-beat slightly to the left and 1½ inches below the nipple. A soft systolic hemic murmur present.

Abdomen.—A large tumor mass extending as high as the umbilicus on the right side and upward toward the costal arch on the left side was outlined by palpation. Upon bimanual examination this tumor mass was found to be intimately connected with the uterus. In fact, the uterine body could not be made out separately from the tumor, which filled the pelvic basin and extended high up almost to the costal arch on the left side. The mass, which was nodular, was movable to a fair degree in the upper portion, while that part within the pelvis was more or less fixed.

Blood examination at this time gave 5000 leukocytes per cubic centimeter; erythrocytes, 3,000,000 per cubic centimeter. Differential white count showed 68 per cent. polymorphonuclear neutrophils; 27 per cent. lymphocytes; 2 per cent. large mononuclears; 3 per cent. polymorphonuclear eosinophils. Hemoglobin, 40 to 45 per cent.

Blood-pressure.—Systolic, 110; diastolic, 75; pulse pressure, 35.

Urinalysis.—1190 c.c. in twenty-four hours. Specific gravity, 1010; reaction, alkaline; albumin, 3 plus—quantitive, 15 grams per liter, or 0.15 per cent.; sugar, none; granular and hyaline casts, many.

Diagnosis.—Multiple uterine fibroids, secondary anemia, and chronic nephritis.

What to do in this case was a question. It was quite evident that the patient could not withstand another hemorrhage. Her general condition, the secondary anemia, and the nephritis made the danger of anesthesia and operation very great. Under these conditions the patient was given absolute rest, as nutritious a diet as the condition permitted, medication for the heart and anemia, and we waited hoping that before another hemorrhage would occur the patient's condition would have so far improved that she might be operated on.

The patient progressed fairly well for three weeks, when hemorrhage began again, and in order to prevent the loss of what gain she had made operation was performed at once. The blood examination at this time showed 14,250 leukocytes; 3,950,000 erythrocytes; hemoglobin 45 per cent.

Urinalysis.—Specific gravity, 1010; reaction, alkaline; albumin, 2 plus; sugar, none; hyaline and granular casts.

You will readily agree with me that the prognosis in this case was not good. My greatest concern was for the anesthetic, but I am glad to say to you that I have never had a better anesthetic given a patient of mine. There was complete relaxation, allowing the rapid removal of the tumor, and yet the patient was practically awake before the dressings were applied and she was removed from the operating-room. There was no postoperative emesis, no distention of the abdomen, or gas-pains. She did not receive any morphin following the operation. The functions of the bladder and rectum were performed without any aid. In fact, the postoperative history of the case has been ideal, and I assure you that the careful administration of the anesthetic had a great deal to do with it.

The tumor, which will be passed around for your inspection, consists of a mass of fibroids of the uterus (Fig. 525). It measures 11 x 8 x 6 inches. The left side is larger than the right. Two of the fibroids on the left and one on the right side were intraligamentous. The body of the uterus has been opened, disclosing several submucous fibroids, one about the size of a small egg. The body of the uterus is rather soft to the touch, evidently undergoing degenerative changes.

Today, six weeks following the operation, the blood examination gives leukocytes 6000; erythrocytes 4,100,000; hemoglobin 85 per cent.

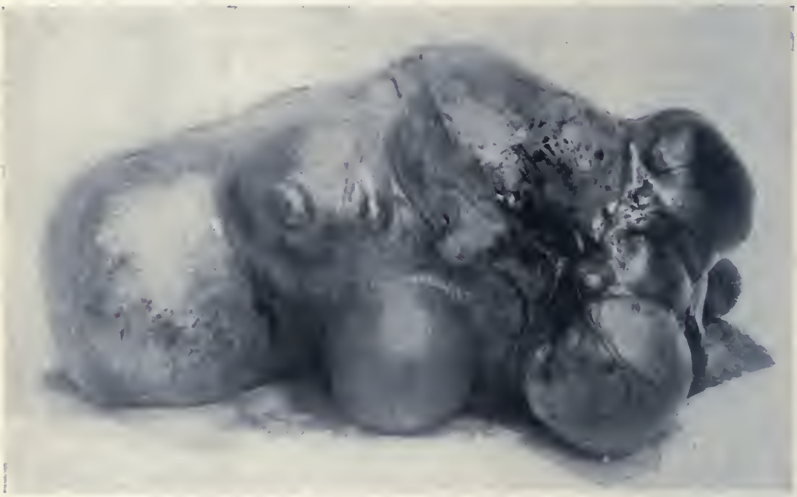

Fig. 525.—Uterine fibroids removed at operation on case demonstrated.

Urinalysis.—Specific gravity, 1018; reaction, alkaline; albumin, good trace; sugar, none; granular and hyaline casts, a few.

The patient's color has improved a great deal. There is no longer any difficulty of respiration; heart action good; pulse 80; appetite good; bowels regular. Patient takes exercise in the open air every day, either walking or motoring, and says that she is feeling very good. We are very much gratified at the result in this case, and the patient will be advised to place herself under the care of an internist for such future medical treatment as her condition may require.

EPIGASTRIC HERNIA—HERNIA OF THE LINEA ALBA

Summary: Pathologic anatomy of hernia of the linea alba; technic of curative operation.

Mr. T. C. is forty-nine years of age; an Italian laborer. He gives no history of previous illness or injury. Has always done heavy work as a laborer. Four months ago he began to have pain in the epigastric region. At first it was more of a burning sensation; later the pain became more marked and there was nausea and vomiting following the eating of his meals. He says that he also has to belch a great deal of gas. A short time after he began having pain a small nodule was noticed in the median line of the epigastrium about 2 inches above the umbilicus. This nodule has increased to the size of a walnut when he is lying down, but when he stands up or strains, as in coughing, the mass increases to about the size of a small fist. He has lost some weight, because he says that when he eats the pain and vomiting distress him so much that he would rather not eat.

There is nothing unusual in the physical examination of the patient, except this mass in the midline above the umbilicus, of which he complains.

The diagnosis is quite plain. There is a swelling in the midline, or linea alba, above the umbilicus. The swelling disappears to a great extent but not entirely when the patient lies down. There is an impulse communicated to the mass when the patient coughs. Some tenderness is complained of when pressure is made over the mass. Plainly, we have to deal with a hernia of the linea alba or an epigastric hernia. All hernias that occur in the midline of the abdomen, with the exception of those that occur at the umbilicus, are called hernias of the linea alba. They are more frequent above the umbilicus than below, owing to the greater width of the linea alba above the umbilicus. Longitudinal bulgings of the linea alba are occasionally called hernia, but they are not hernia in the true sense of the word, because there is no defect in the transversalis fascia. These bulgings are caused by wide separation of the recti within their sheaths.

Epigastric hernia vary greatly in size; some may be no larger than a pea, others again may attain the size of a fist. The larger sizes usually occur in the immediate vicinity of the umbilicus.

The linea alba is an aponeurotic structure formed by the union of the sheaths of the recti on either side. It is broader above the umbilicus than below, and is in relation posteriorly with the peritoneum, but separated from it by the transversalis fascia.

These herniæ consist frequently of protrusions of subserous fatty tissue through congenital or acquired openings in the linea alba, and resemble lipomas. A portion of peritoneum is drawn through the opening into the center of these masses when they have persisted for some time, and true hernias are thus induced. Considerable pain and abdominal distress, vomiting, colic, etc., are caused partly by traction on the peritoneum and partly by constriction of the neck of the sac against the sharp edges of the small opening.

Treatment.—In some of the smaller hernias of the linea alba it is questionable if there is a true hernial sac. In the present case, on account of its size, the fact that it can be partly reduced, and the impulse communicated when the patient coughs, I am convinced that we have a true hernia of the linea alba.

Operation.—Ether anesthesia. The patient having been properly prepared, an incision about 3 inches in length is made over the center of the protruding mass (Fig. 526, 1). Care must be exercised in carrying the incision through the covering of the hernia, in order to avoid injury to any of the structures which may be found in the hernial sac. The skin and subcutaneous fat are dissected back freely on both sides, exposing the sheaths of the recti muscles (Fig. 526, 2). The hernial sac is exposed, incised, and the adherent omentum which it contains is freed and returned into the abdomen. The peritoneal opening is now closed with a continuous catgut suture (Fig. 526, 3).

The sheath of the left rectus muscle is split by a vertical incision about ⅜ inch from its median edge and the flap reflected

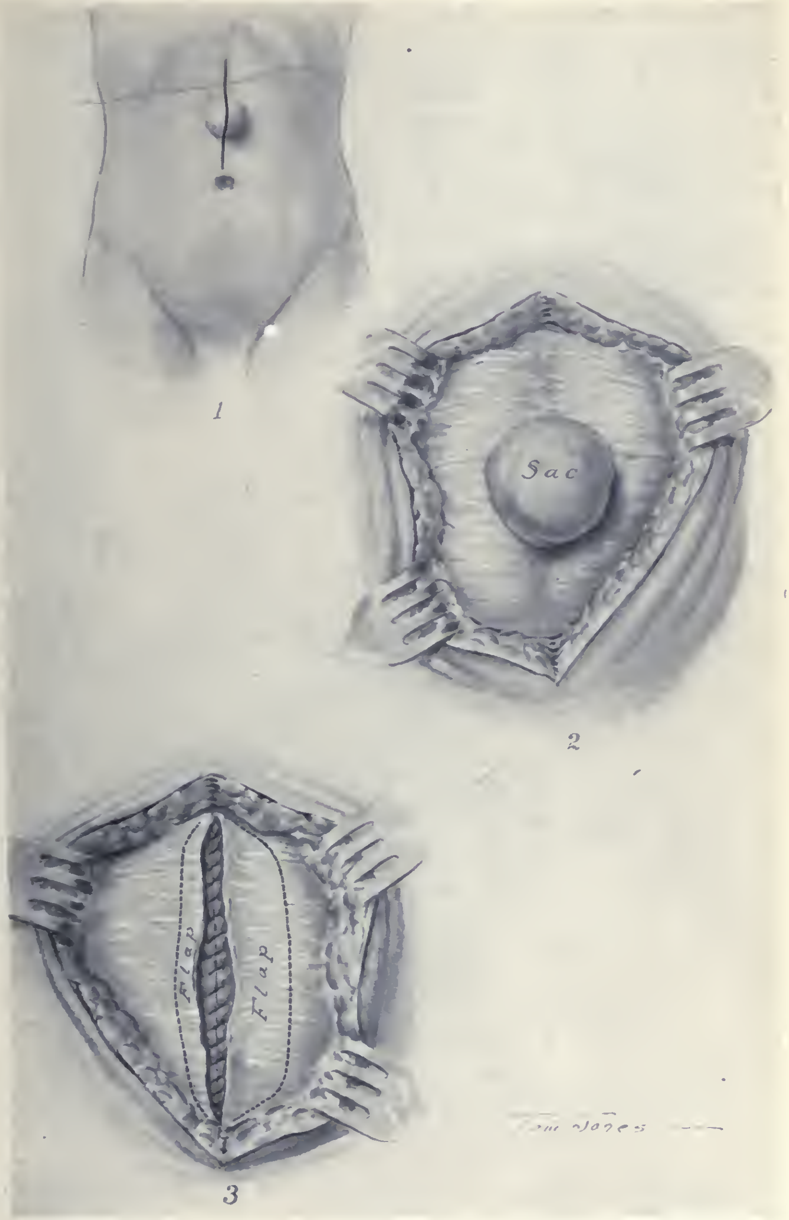

Fig. 526.—1, Incision made over middle of bulging; 2, skin and superficial tissues retracted, exposing sac and rectus fascia; 3, sac excised, peritoneum closed, and flaps outlined in rectus fascia.

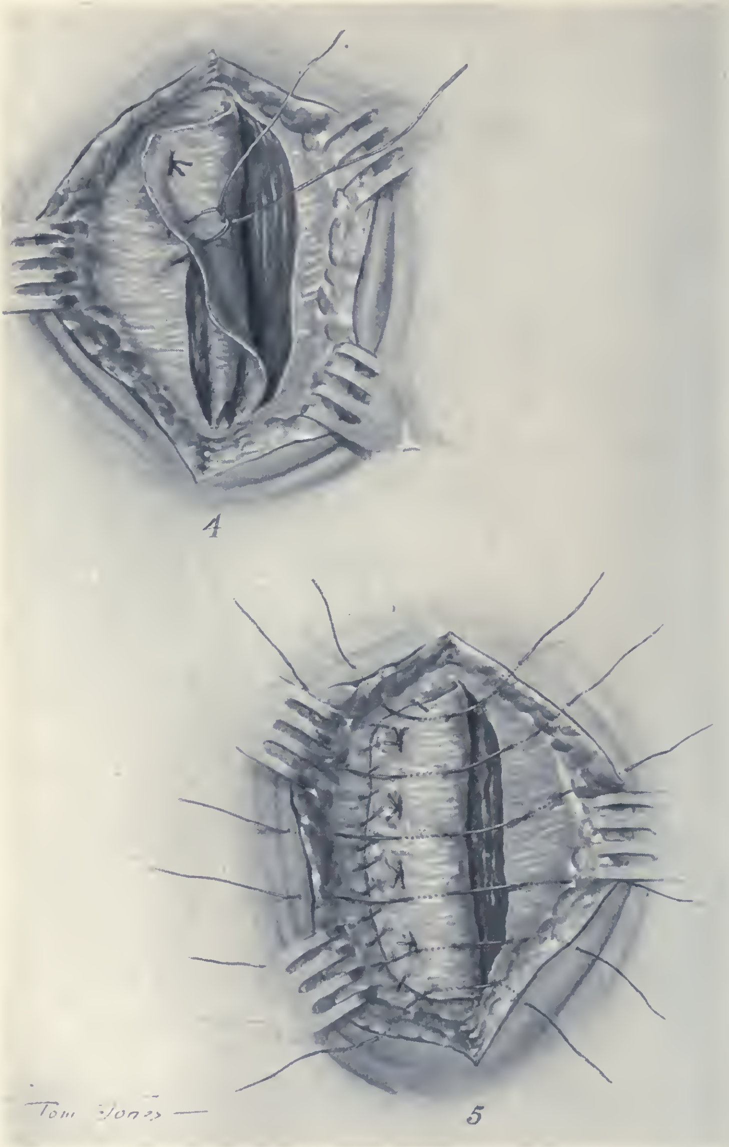

Fig. 527.—4, Flaps of anterior sheath of rectus muscles imbricated over site of hernia by mattress sutures; 5, closure about to be completed by means of silkworm-gut sutures including skin and rectus fascia as indicated.

toward the median line. The sheath of the right rectus muscle is split in the same manner about ¼ inch from its median edge and the flap reflected toward the median line. With chromic catgut an interrupted mattress suture is now placed, beginning about ½ inch from the free edge of the flap of the rectus sheath on the right side and returning through the flap on the left side. It will be necessary to place four of these sutures, and when they are tied, the posterior sheath of the right rectus, with the transversalis fascia, is brought into apposition and underneath the flap of left rectus sheath, with the transversalis fascia (Fig. 526, 3; Fig. 527, 4). The free overlapping edge of the left rectus sheath is now sutured with a continuous chromic catgut suture to the anterior sheath of the right rectus. By this method the strongest tissues (the fasciæ) are utilized in forming a new abdominal wall. There should be no tension on these flaps when brought together. The external opening is closed by interrupted silkworm-gut sutures. These sutures are passed from the left side, first through the skin, then picking up the free edge of the left rectus sheath, then the center of the fascial flap, and finally through the skin of the right side (Fig. 527, 5). A few superficial sutures are taken to coapt the skin edges and then the interrupted silkworm-gut sutures are tied over a strip of gauze, but not too tightly. This obliterates all dead space in the wound. The operation is now completed, and there is a good firm abdominal wall, made up of the best tissues available for that purpose. The external sutures will be removed about the tenth day and there is no doubt that a cure will be obtained in this case.

GUNSHOT WOUND OF THE BUTTOCK

Summary: A patient with a gunshot wound of the buttock in which the bullet apparently traversed the pelvis without injury to the pelvic viscera; value of stereoscopic roentgenograms in cases of this type.

G. B., aged seventeen years, schoolboy. This patient is a victim of the race riots, which have been going on for the past few days. Briefly, the history is that, while walking down the street on his way home in company with several other boys about his age, he encountered a crowd, and, fearing trouble, started to run in the opposite direction. The boy says that he had not gone very far when he experienced a severe, burning, stinging pain in the buttocks and he immediately dropped to the sidewalk. He was unable to get up and walk. Whether his inability to do so was due to the attending fright or the injury itself could not be determined at that time. He was placed in an ambulance and removed to the hospital.

Upon examination, shortly after his admission to the hospital, the patient was found to be a healthy looking boy, well nourished, and with no other complaint than that due to the present injury. He was in a highly nervous state and complained of severe pains in the buttocks.

The only external mark of injury that could be found was the wound of entrance of the bullet, which was situated about ½ inch below and to the inner side of the tip of the greater trochanter of the right femur.

An *x*-ray plate, made with the boy lying on his back, shows the bullet apparently behind and above the tuberosity of the left ischium. How the bullet could travel across from the right to the left side without injury to the bladder or rectum is very difficult to explain.

The patient has voided urine and it is perfectly clear; it contains no blood. By rectal examination no injury of the rectum can be determined. It is now twenty-four hours since the injury occurred and there have been no symptoms developed indicating injury to any important structure or organ.

This first x-ray plate, which was taken with the boy lying on his back, shows, as stated before, the bullet apparently behind and above the tuberosity of the ischium. However, this kind of a plate is not satisfactory in a case of this type. The bullet has traveled from one side to the other, and, keeping in mind the formation of the pelvic bones, I have disagreed with the interpretation of this plate given to me and, therefore, have had a set of stereo-x-ray plates made. By studying these stereoplates, the position of the bullet is shown to be to the pelvic side and slightly embedded in the ischium, about $\frac{5}{8}$ inch above the tuberosity (Fig. 528). In cases of this kind, as well as injuries to the joints, the skull, the thorax or abdomen, it is much more satisfactory to make stereoplates than to use the ordinary single plate.

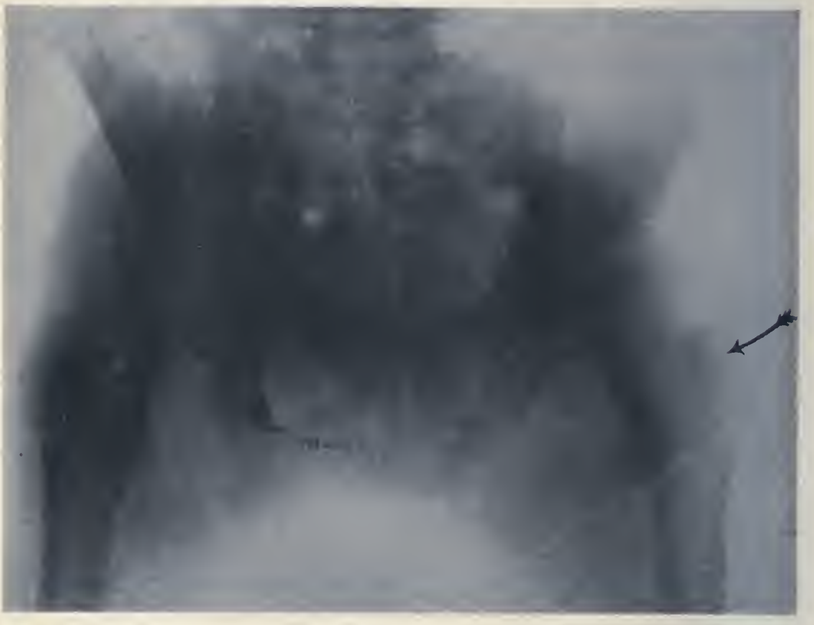

Fig. 528.—x-Ray photograph showing bullet embedded in left ischium; the point of entrance was over the greater trochanter of the opposite side.

Operation.—Ether anesthesia. The patient has been prepared and he will be placed upon his left side, the right leg flexed upon the thigh and the thigh upon the abdomen, and the entire right limb carried forward. This gives practically the left lateral or Sims' position. The incision, about 2½ inches in length, is made directly upon and down to the tuberosity of the left ischium. Care will be taken to avoid cutting important structures, the muscles being separated in the direction of their fibers. Having come down to the tuberosity of the ischium, a blunt dissection is now made upward on the pelvic side of the bone. The incision is not so large as to allow one to see definitely in the bottom of the wound, hence one must depend to a certain degree upon the sense of touch. If the bullet is not encountered soon the incision will be enlarged. By carefully dissecting our way upward for a short distance, I believe that the instrument in my hand is in contact with the bullet; in fact, I am sure of it, and the bullet is now extracted by the use of a forceps. The bullet is somewhat roughened from its contact with the bone, in which it was slightly embedded. The distance from the point of entrance to the point where the bullet was found is about 8 inches.

The wound will be closed in the usual way. A small gutta-percha drain will be inserted and allowed to remain for forty-eight hours.

Before finishing this operation I want to see if it can be determined how the bullet went across from the right side to the left side. A flexible probe is introduced into the wound of entrance and the track of the bullet followed. This leads down to the coccyx, and its further direction is lost. It did not pass posteriorly to the coccyx, of that we are certain, and yet by rectal examination the rectum is found to be in very close relation to the coccyx, and it is difficult to understand how the bullet could have passed across without injuring the rectum. The position of the bullet would indicate that when it struck the pelvic side of the ischium, its further progress was arrested and it was turned upward and slightly embedded in the ischium. It is remarkable, in some cases of gunshot wounds, the course that a bullet may take and at the same time not produce any serious injury to the various structures or organs which apparently are in the trail one would think the bullet had taken.

CONTRIBUTION BY DRS. WESLEY J. WOOLSTON AND W. B. WHITE

Cook County Hospital

REPORT OF 1000 PATIENTS OPERATED ON FOR TUBAL INFECTION

Summary: High percentage of patients once operated on for pelvic disease requiring secondary operations; mistakes in diagnosis and failure to remove all diseased tissues chief factors responsible; notes on choosing method of treatment.

The object of this report is not to offer any new form of management in the treatment of tubal infections, but to condemn the practice of unnecessary or incomplete operations, and to emphasize the necessity, when operating, of removing all the pathology.

Women who have had a unilateral salpingectomy, oöphorectomy, salpingo-oöphorectomy, or double salpingectomy, often leaving an infected uterus, tube or portion thereof, frequently are seen by the gynecologist because they complain of as many if not more symptoms than they had before operation.

Because so many of these cases are seen we thought it would be of interest to ascertain the percentage coming to operation who had previously been operated upon for pelvic infections. In the last 1000 cases operated upon at Cook County Hospital 49, or 4.9 per cent., had had partial removal of the reproductive organs, such as oöphorectomy, salpingectomy, or more frequently salpingo-oöphorectomy.

Besides these cases there were a number who were found at operation to have had a chronic pelvic infection, yet had undergone some irrelevant operative procedure for the condition. These operations consisted of curetments, round ligament operations, and appendectomies. From the histories of these cases and the pathology found at the second operation it seemed probable that the original trouble was tubal in origin. In the 1000 cases there were 89, or 8.9 per cent., in this class. These cases do not include acute salpingitis nor do they include cases where infection occurred subsequent to the first operation, as near as we could ascertain. Of the 1000 cases operated upon for chronic salpingitis, therefore, 138, or 13.8 per cent., had previously been operated upon because of symptoms referable to the pelvic condition. These figures are almost certain to be too low, inasmuch as a large number of cases who still had trouble would not return, and many who did return refused operation or were not operated upon for some other reason.

Another point of interest in this series is the death-rate, which is 2.5 per cent. The average age of these patients is 25½ years.

We do not mean to say that sometimes a secondary operation will not be necessary. But we believe that the number should be smaller. There are cases in younger women where it is highly desirable to save one or both ovaries. It is often questionable whether an ovary should be saved or not; in such cases we save it as the lesser of two evils. In doing so we attempt to preserve the blood-supply to prevent cystic degeneration, and still sometimes such an ovary will cause trouble. Admitting this, we feel that it is still worth while in young women to preserve the internal secretion from the ovary if we can consistently do so. However, we do not feel that preservation of diseased ovaries is justifiable even in young women.

We would divide the treatment of chronic pelvic infections into the conservative and the radical. The choice of treatment depends upon the social condition of a patient to a great extent. If a person is well to do, rest in bed, good nursing, and general hygienic measures will cure many cases. These cases can well afford to risk a certain number of acute exacerbations in the hope that spontaneous healing may occur and operation be thus avoided. With the less fortunate patient who cannot afford to be sick, because she is employed or because she must go to a charity hospital where beds are limited, operation is indicated sooner. Also, if a patient has a family of children or is beyond the climacteric she may submit to a radical operation; whereas, a patient who has no children but who is within the child-bearing age and desires motherhood, can afford to take conservative measures over a longer period of time, hoping that nature will heal the tubes so that conception may take place.

If operation has been decided upon, which, of course, is never during an acute attack, one should be sure and remove all the pathologic tissue, which is so often only partially removed. In the gonorrheal form the infection is practically always in both tubes as well as in the *pars interstitialis.* This means a hysterectomy or an amputation of the uterus, which is sometimes called a Bell Beutner operation, as modified by Pollak. In the streptococcic form of infection, in which the patient has survived the acute stage, but where symptoms remain, operation is delayed as long as possible, as latent organisms are sometimes aroused to activity by operative interference, and an apparently simple case will die of streptococcic peritonitis.

Following hysterectomy, if care has been taken to cover all the raw edges which have been created by the removal of the uterus, with the reflected peritoneal surface of the bladder, very few adhesions will take place even in the cases where many adhesions previously existed. This procedure also holds the stump of the uterus forward and the bladder upward. In view of this fact fewer symptoms follow hysterectomy than in days gone by when a hysterectomy often left much trouble. In the high amputation operation menstruation can be preserved and still the pathology be removed. In doing this operation one might ask, Why preserve the menstrual function? Although its preservation is considered purely sentimental by some, it seems worth while where we can safely do so. We must, however, remove all pathology irrespective of age or other conditions.

CLINIC OF DRS. GUSTAV KOLISCHER AND J. S. EISENSTAEDT

Michael Reese Hospital

LESIONS OF THE FEMALE URETHRA: DEMONSTRATION OF FOUR CASES

Summary: Case I.—Neuro-angioma of the urethra—typical clinical picture.

Case II.—Angioma cavernosum—diagnosis.

Case III.—Angiosarcoma—characteristic history and findings on examination. Discussion of treatment of above conditions—removal by cautery the method of choice—advisability of subsequent radiotherapy in Case III.

Case IV.—Gonorrheal granuloma—diagnosis; necessity of radical treatment by curet and galvanocautery.

Case I.—The patient complains of persistent disagreeable sensations in the urethra which occasionally take on the character of sharp pains, beginning at the meatus urethræ and radiating toward the clitoris. There is no relation between the act of urination and the occurrence of the annoying sensations and attacks of pain.

Inspection of the labia majora is negative. The external urethral opening is somewhat gaping and presents, in the lower half of its circumference, an irregular, raspberry-like excrescence. This nodule is about the size of a large pea, has a broad base, and extends about 3 mm. into the urethra. The surface is not excoriated, is not sensitive to touch, and does not bleed on palpation. Urethroscopy and cystoscopy reveal no abnormalities.

Such a growth is commonly termed "caruncle of the urethra." The occurrence, however, of spontaneous pain in this tumor suggests the presence of nerve fibrillæ in the lesion.

Clinical Diagnosis.—Neuro-angioma.

Case II.—The patient, a woman of thirty-five years, reports that the urine is frequently bloody; also that apart from the act of micturition there occurs occasionally a sudden flow of blood from the vulva. Menstruation has no relationship to this occurrence. Urination is not painful nor are there any abnormal sensations in the parts.

Inspection of the external urethral opening reveals the presence of two tumors in the lower half of the circumference of the orifice, the lips of which are somewhat protruding. These tumors are pedunculated, bean size, bright red in color, and not sensitive to touch. Under pressure they loose their bright red color and become pale and reduce in size. Close inspection with the magnifying glass shows a minute black spot which has lost its glistening surface. This is seen at the upper surface of one of these tumors. The black spot just referred to represents the site of a previous hemorrhage with subsequent clotting.

Histopathologically these little tumors show angioma cavernosum, a growth made up of cells enclosing blood spaces of variable sizes, surrounded by fine fibrous connective-tissue strands and occasionally unstriped muscle-cells.

Case III.—This patient states that for quite a period each act of urination has been painful. The pain is located at the meatus and persists for some time after the act.

The external urethral opening on visual examination shows, at its lower margin, a tumor the size of a small marble. The nodule has a broad base and is grayish-red in color. The surface is irregular and verrucous. In the center is a discolored crust. Touching this discolored area produces intense pain, which is increased by any attempt at detaching the crust. The tumor is slightly compressible. The crust formation is due to retrogressive changes in the tumor, characteristic of a malignant growth.

The diagnosis in this instance is angiosarcoma of the urethral mucosa. The pain in this case is due to the inflammatory changes about the margin of the nodule.

The surgical indication in all these cases is identical. They must all be removed, and it is the method of removal only which can be the subject of discussion. Removal with the knife and closure with suture may often be not only a difficult and tedious task, but experience has shown that in many instances multiple and rapid recurrences follow. The destruction of these growths by the actual cautery is an easy matter and if done thoroughly furnishes lasting results. It is a matter of individual preference and not of essential significance whether to cauterize by actual cautery agents, by means of the Paquelin, the galvanocautery, or by fulguration.

In order to protect the normal mucosa during cauterization an olive-wood stick is introduced into the urethra. Any of these methods may be done successfully under local anesthesia. In order to prevent recurrence in the case of angiosarcoma, cauterization will be followed by radiotherapy.

Case IV.—The next patient is a girl of twenty-five who complains that in spite of treatment administered for over six months she is still suffering from burning during and immediately after urination, and that her clothes are soiled by a discharge from the genitals. There is a history of gonorrhea acquired about six months ago. No intrapelvic pathology has been recorded. The urine voided is slightly turbid.

The lips of the external urethral orifice are somewhat everted and seem to be swollen. Stripping of the urethra by means of a finger inserted in the vagina produces a drop of viscid grayish fluid. Microscopic examination of this discharge shows pus-cells containing diplococci and other bacteria. The vagina and cervix are apparently normal. While a steel sound may easily, and without especial discomfort to the patient, be passed into the urethra, upon its withdrawal a few blood streaks are discovered on its surface. This finding calls for ocular inspection of the urethra.

Endoscopic examination shows the appearance of several reddish excrescences extending into the urethral lumen. If, by introducing a fine curet through the urethroscopic tube, the lowest lesion is removed, it is seen that underlying this growth there is a discolored cleft in the mucosa. Examination of the tissue removed shows it to be granulation tissue.

Diagnosis.—Inflammatory granuloma of gonorrheal origin with fissure formation. Further histopathologic examination will invariably show that in the vacuoles of these granulations gonococci are found. It is thus easy to explain the persistence of the gonorrhea. As long as these granulations and ulcerations in the mucosa persist infection will be maintained, and therapy, therefore, must be radical. The granulomata should be scraped off by using a sharp curet through an endoscopic tube and the ulcerations thoroughly cauterized with a fine galvanocautery.

CLINIC OF DR. HERMAN L. KRETSCHMER

Presbyterian Hospital

DIAGNOSIS OF URETERAL CALCULI

Summary: Sources of error in interpretation of simple *x*-ray plates and of shadowgraph catheter plates showing apparent calculi; stereoscopic *x*-rays; author's method; remarks on choice of methods of treatment—indications for open operation; retrograde movement of ureteral calculi.

Much has been written in the past few years about the diagnosis of stone in the ureter, and the entire trend of thought has been to render the diagnosis as accurate as possible. When ureteral stone work was first done simple roentgenograms were taken, and shadows were seen on the *x*-ray plate that were interpreted to be stones, but at operation no stone was found. With the introduction of the shadowgraph catheter a great many of these shadows were proved to be of extra-ureteral origin, but a small group of cases remained in which the catheter and shadow-producing body were apparently side by side. In a few instances such patients were operated upon and no stone found. This still left the method of diagnosis by simple shadowgraph catheter and Roentgen ray open to certain chances of error. It was then suggested that these doubtful cases should have stereoscopic roentgenograms taken in order to reduce the possibility of error. Recently at the Presbyterian Hospital we have been using a new procedure, which I described in Surgery, Gynecology, and Obstetrics in November, 1918. Briefly, this consists of the following:

In a given case of suspected stone in the ureter a shadowgraph catheter is passed and the patient taken to the x-ray room where a double exposure is made on a single plate with a shift in the tube. In cases of stone in the ureter both exposures will show the shadow of the stone and the shadow produced by the shadowgraph catheter lying side by side. In cases in which the shadow-producing body is of extra-ureteral origin but lying in the same plane as the catheter, it produces a picture as though the shadow-producing body and catheter were lying side by side; the second exposure, however, shows a definite interval between the shadow under suspicion and the catheter. This procedure we believe to be of definite advantage in the diagnosis of stone in the ureter, and it furthermore reduces the source of error mentioned above—that of misinterpreting an extra-ureteral shadow, and operating upon a patient unnecessarily.

The patient I shall demonstrate this morning presents the following clinical picture:

Mrs. P., aged thirty-seven, admitted June 16, 1919. She was operated on for gall-stones in 1904. Never cystoscoped before. Had Roentgen ray examinations made in 1917 and 1918; no stone was found.

Present Complaint.—Pain in the left lumbar region. Three years ago while she was getting dinner she was seized with very sharp, cramp-like pain in the left side, which doubled her up, so that she went to the floor on her knees. Was immediately put to bed and a physician was called, who gave her a hypodermic of morphin. The pain subsided and she had no recurrence for the next three or four months. While the patient was in the country she was again seized with very severe pains. This time the pain was accompanied by chills and fever and the attack lasted about one week. The patient was taken to the hospital, where she remained for three weeks. Three weeks after her arrival home she was again seized with the same sharp, cramp-like pain, chills, and fever. She remained home for a week and then went back to the hospital, where she remained three weeks, during which time she had one attack. Since then the patient has had attacks every two or three months, which are similar to the previous attacks. Three weeks before entering the Presbyterian Hospital she had her last attack. During this attack there was nausea and vomiting and some radiation of the pain to the inguinal region.

Urinary Incontinence.—For one night during the second attack patient lost control of the urine, the urine dribbling more or less continuously for six or eight hours.

Menstrual History.—Began at thirteen, twenty-eight-day type, no dysmenorrhea. Married; one son and two daughters living and well.

Family History.—Negative.

Physical Examination.—Scalp negative. Pupils are equal and respond to light and accommodation. Impaired hearing in left ear.

Chest.—Lungs—expansion good; no areas of dulness; no râles. Heart—not enlarged; no murmurs.

Abdomen.—Liver, kidney, and spleen not palpable. No tumor masses felt. Slight tenderness on deep pressure in left lumbar region. No swelling or other symptoms.

Reflexes.—Knee-jerks absent.

Cystoscopic Examination.—Bladder negative except for a few slight irregularities at the neck. Ureters normal. Ureteral catherization easy and without obstruction.

Cell Count and Cultures.—Bladder, 30; right kidney, 8; left kidney, 230. All three specimens are sterile.

x-Ray Examination.—Shadowgraph catheter in a single exposure shows catheter running to the median side of a stone; double exposure shows shadow under suspicion lying in same relation to both catheters (Fig. 529).

Blood Examination.—4,100,000 red cells; 14,100 white cells; 85 per cent. hemoglobin.

Blood-pressure.—Systolic, 128; diastolic, 84.

Urinalysis.—Cloudy; straw-colored; 1014; alkaline; no albumin, sugar, or casts; few epithelial cells; no blood.

Blood Urea.—170 mg. per liter; chlorids, 4.7 grams per liter; nitrogen, 20.2 grams per liter; carbon dioxid, 48.1 c.c.

Wassermann negative.

Discussion.—A tentative diagnosis of stone in the ureter was made. A shadowgraph catheter was passed and the procedure just mentioned carried out. In this plate you see that in both exposures the shadow produced by the stone hugs the shadow produced by the shadowgraph catheter (Fig. 529). Therefore, I believe, we are justified in making a diagnosis of stone in the ureter.

I believe that every patient with stone in the ureter should be treated by non-operative measures first and open operation reserved for the cases in which instrumental manipulation fails.

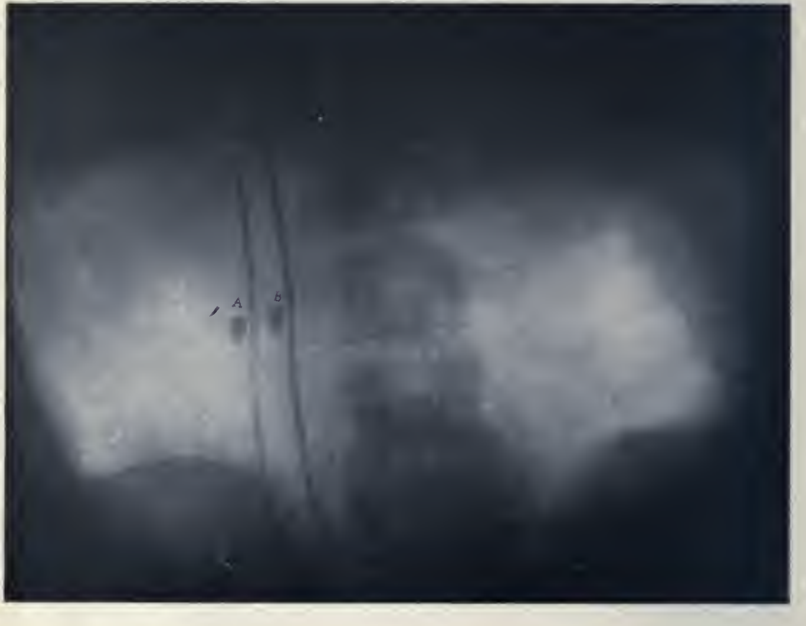

Fig. 529.—*x*-Ray photograph illustrating the author's method of diagnosing ureteral calculus. With a shadowgraph catheter in place, a double exposure is made on a single plate; if the shadow under suspicion and the catheter maintain the same relative position to each other in both exposures the diagnosis of ureteral calculus is verified.

Accordingly, after we were through collecting the urine for examination we injected 10 c.c. of sterile olive oil into the left ureter.

Following this injection of oil the patient had a very severe attack of renal colic. The pain was described by the patient as being lower than in any of the previous attacks. She pointed to the pain as being down in the bony pelvis. Another roentgenogram was taken to see whether or not the stone had moved, and this *x*-ray showed the stone located in the bony pelvis, so we knew the stone had wandered from its previous position opposite the third lumbar vertebra down into the bony pelvis.

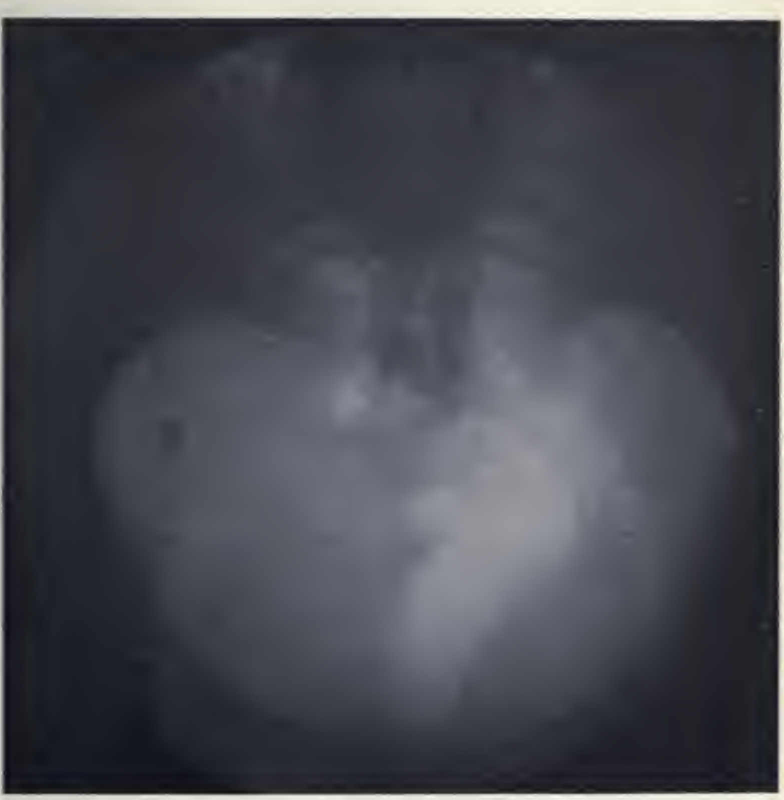

Fig. 530.—*x*-Ray photograph of same patient as in Fig. 529, made a few days following an attack of colic induced by the intra-ureteral injection of olive oil. The shadow under suspicion now lies in the pelvis, thus giving additional support to the diagnosis.

This fact furthermore verified the previously made diagnosis of stone in the ureter (Fig. 530).

Note.—On July 7, 1919, four days after the first injection, 15 c.c. of oil were injected into the left ureter, and on July 9th

20 c.c. of oil were injected. We are contemplating further injections.

Although this case is demonstrated to illustrate the advantage of the method of diagnosis of stone in the ureter just described rather than to dwell on the treatment of such cases by intra-ureteral injections of oil or by open operation, I shall mention one or two points in connection with the latter. It is a well-known fact that many cases of stone in the ureter, if given half a chance, will pass the stone, and we believe that open operation should be reserved for cases in which intra-ureteral manipulations fail. After having given this patient a fair chance with this form of treatment, if this treatment fails we will then advise open operation.

Operation for stone in the ureter should always be extraperitoneal and never intraperitoneal, owing to the danger of the development of peritonitis. One fact that must always be borne in mind in the treatment of stone in the ureter, whether that treatment be operative or non-operative, is the possibility of the stone migrating back up the ureter. Cases have been reported in the literature in which a definite diagnosis of stone in the ureter was made and in which at operation no stone was found. A subsequent check-up by means of the *x*-ray demonstrated that the stone had wandered back up into the ureter. Occasionally the stone may even wander back into the pelvis of the kidney. Two years ago I had such an experience at the Presbyterian Hospital. The patient had received several intra-ureteral injections of oil, and then he was called home to West Virginia on urgent business. When he returned several months later for his Roentgen ray check-up, instead of finding the stone in the pelvic portion of the ureter, it was found in the lumbar portion. In another case in which I had planned to operate for stone after many attempts at intra-ureteral manipulations had failed, a similar condition was met with. The stone was situated in the intramural portion of the ureter and I planned to open the bladder and take out the stone transvesically. Just before the patient was anesthetized another *x*-ray was taken, which showed that the stone had wandered back into the ureter between the third and fourth lumbar vertebræ. Had we overlooked this fact, we would have attempted a transvesical removal of the stone, which, of course, would have been unsuccessful because the stone would not have been found.

I mention these two cases as my personal experiences with this so-called retrograde movement of ureteral stones. Doubtless this retrograde movement may take place in two ways. When the stones are in transit down the ureter a certain amount of dilatation of the ureter takes place behind the stone. If the stone is not very firmly fixed in the ureter and is not very large, when the patient is placed in position for operation it is easy to see how the stone might fall back into the dilated ureter. It is a well-known fact that the ureter is capable of retrograde peristalsis, so it may be that these stones are carried back up the ureter by retrograde peristalsis.

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